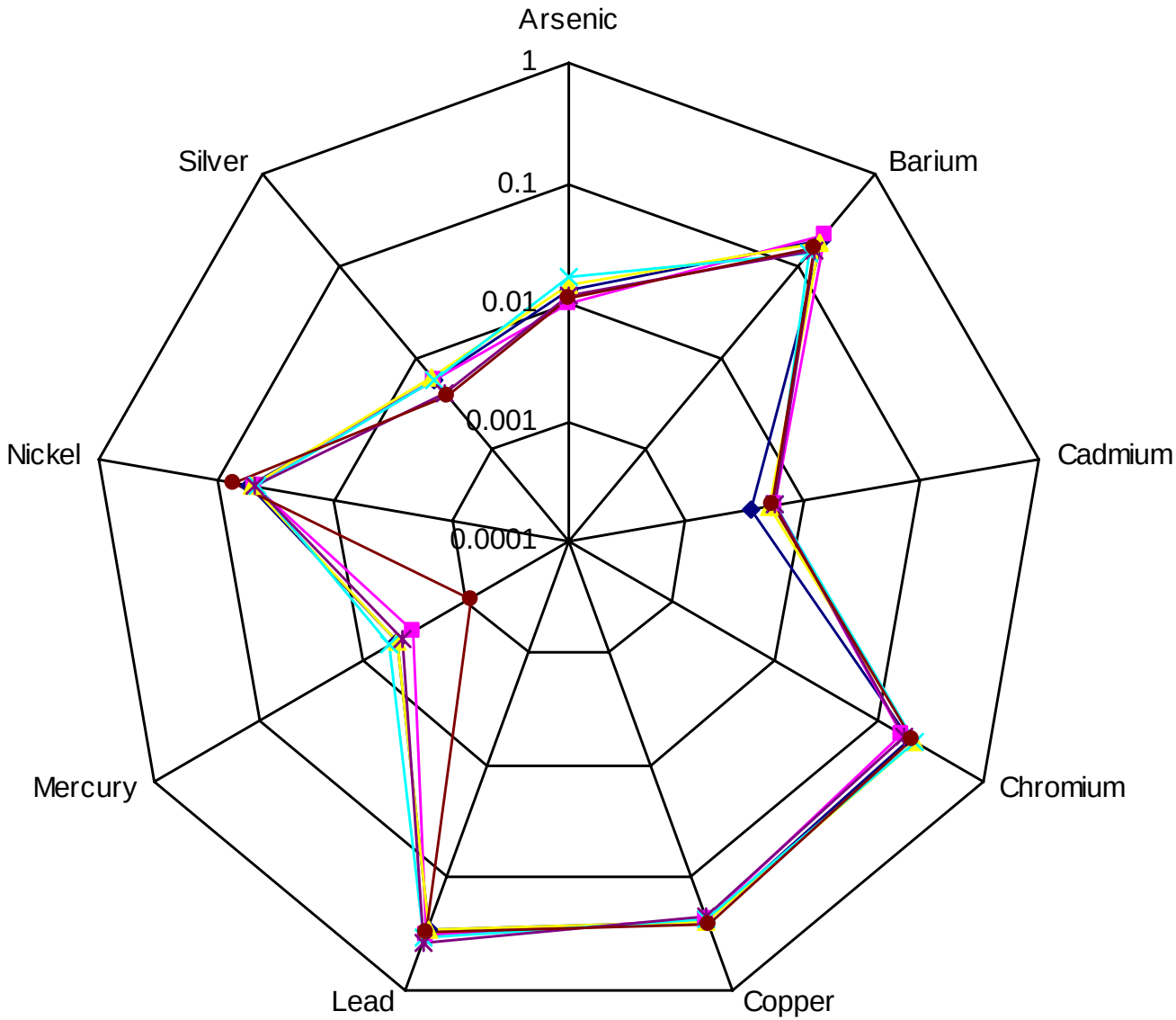


Legend

- TSI-201/RM-1
- TSI-202/RM-1
- TSI 203/RM-1
- TSI 204/RM-1.23
- TSI 213/RM 1.94
- TSI 214/RM 1.94

Location

River Mile 1 to River Mile 2

Note:
Each metal in the radar plot is represented on its own axis, which radiates from the center point of the graph. Metal concentrations are plotted as a unitless mass fraction [concentration of the metal (ug/kg)/ total concentration (ug/kg)]. For clarity, a logarithmic scale is used. Lines connect all the values from a given sample.

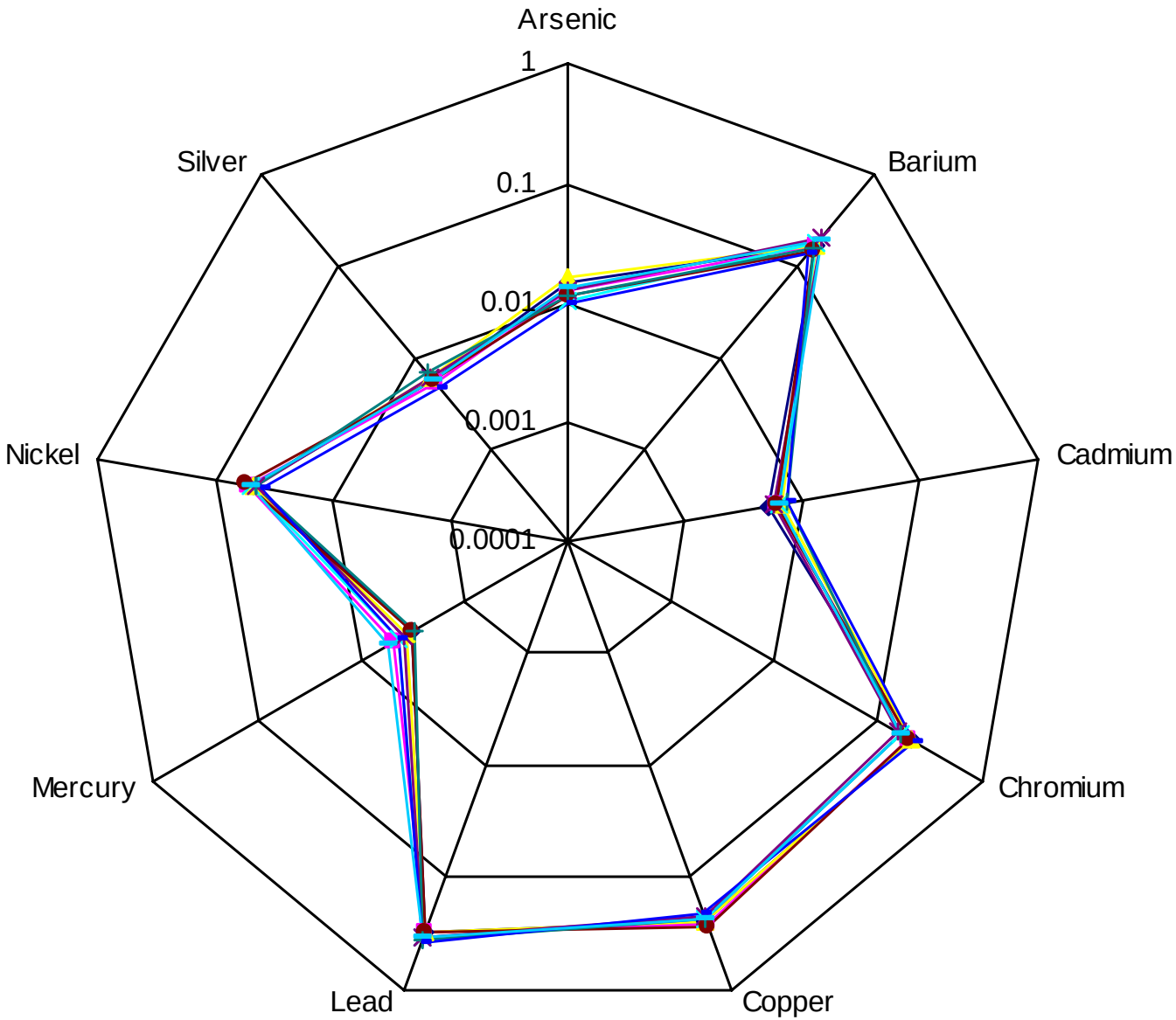
Data Source: Tierra Solutions, Inc. 1995 Dataset. Results are from surface sediment samples(0 to 0.5 foot)

Radar Plot for Selected Metals
River Mile 1 to River Mile 2

Lower Passaic River Restoration Project

Figure 15-1a

September 2008



Legend

- TSI 295 / RM 2
- TSI 282 / RM 2.2
- TSI 283 / RM 2.2
- TSI 222 / RM 2.65
- TSI 223 / RM 2.65
- TSI 284 / RM 2.7
- TSI 225 / RM 2.87
- TSI 227 / RM 2.87
- TSI 226 / RM 2.88

Location

River Mile 2 to River Mile 3

Note:
Each metal in the radar plot is represented on its own axis, which radiates from the center point of the graph.Metal concentrations are plotted as a unitless mass fraction [concentration of the metal (ug/kg)/ total concentration (ug/kg)]. For clarity, a logarithmic scale is used. Lines connect all the values from a given sample.

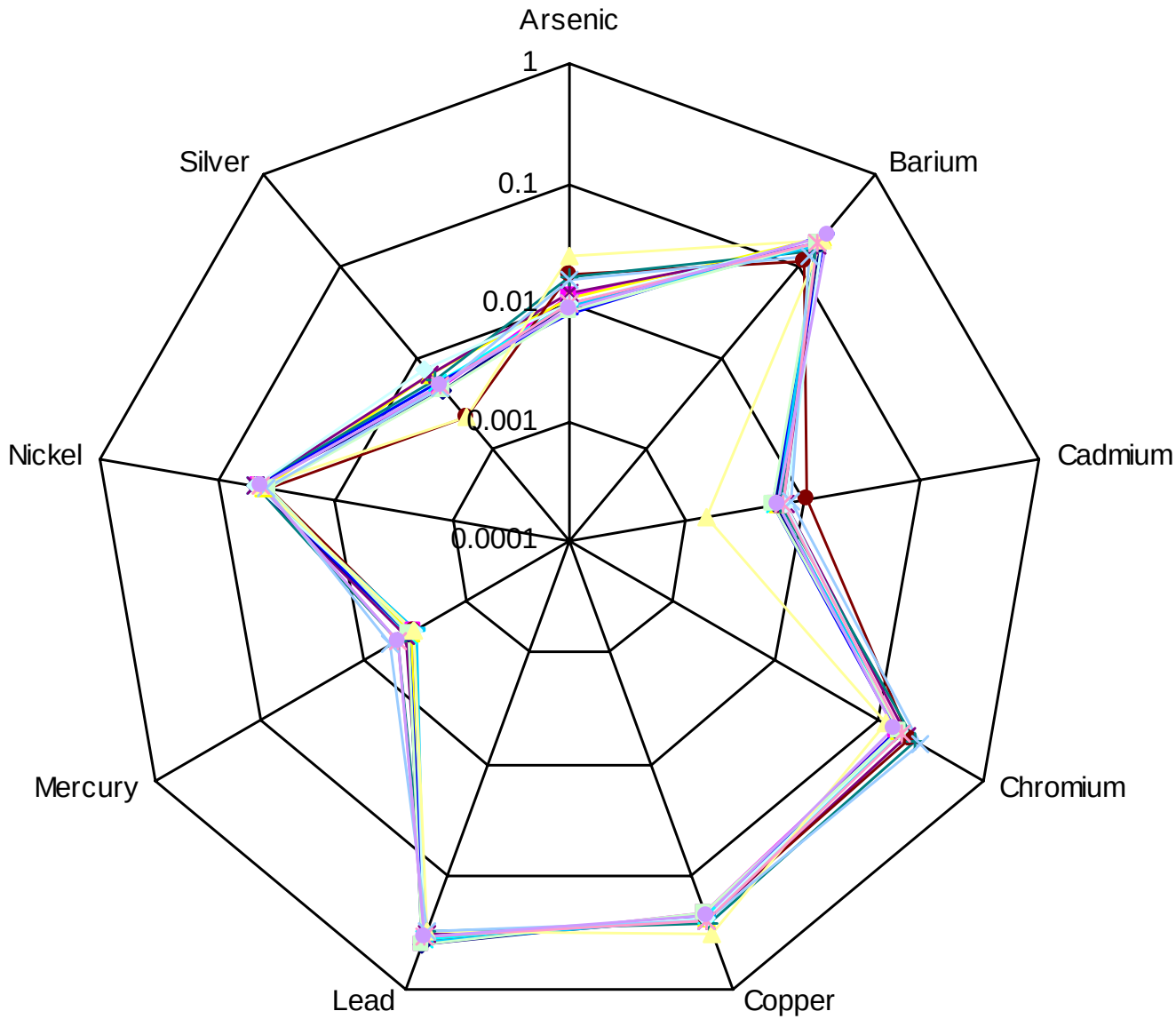
Data Source: Tierra Solutions, Inc. 1995 Dataset. Results are from surface sediment samples(0 to 0.5 foot)

Radar Plot for Selected Metals
River Mile 2 to River Mile 3

Lower Passaic River Restoration Project

Figure 15-1b

September 2008



Legend

- TSI 228 / RM 3.1
- TSI 229 / RM 3.1
- TSI 230 / RM 3.1
- TSI 286 / RM 3.1
- TSI 294 / RM 3.15
- TSI 285 / RM 3.2
- TSI 231 / RM 3.33
- TSI 232 / RM 3.33
- TSI 234 / RM 3.55
- TSI 235 / RM 3.55
- TSI 236 / RM 3.55
- TSI 288 / RM 3.66
- TSI 237 / RM 3.78
- TSI 238 / RM 3.78
- TSI 239 / RM 3.78

Location

River Mile 3 to River Mile 4

Note:
Each metal in the radar plot is represented on its own axis, which radiates from the center point of the graph.Metal concentrations are plotted as a unitless mass fraction [concentration of the metal (ug/kg)/ total concentration (ug/kg)]. For clarity, a logarithmic scale is used. Lines connect all the values from a given sample.

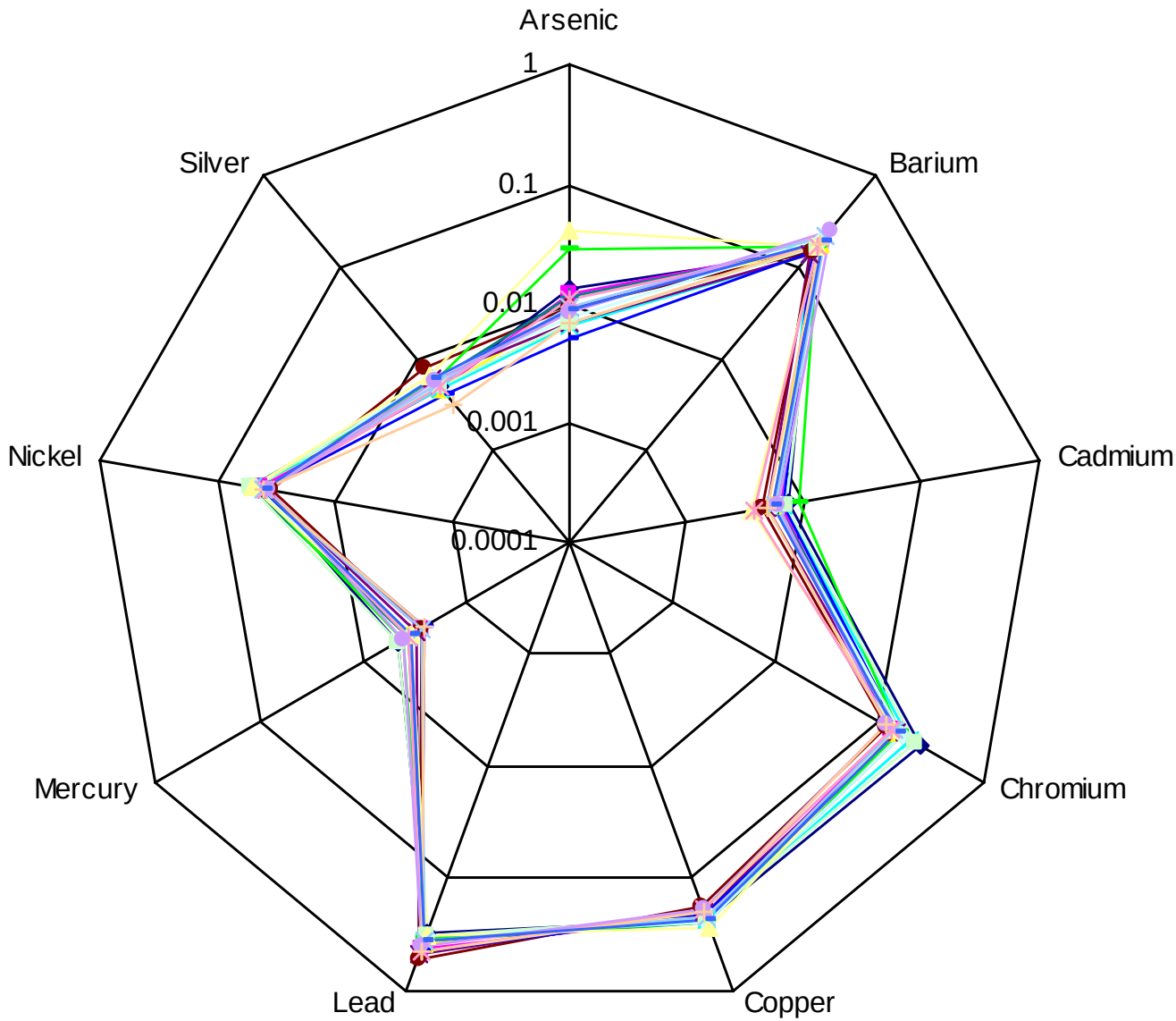
Data Source: Tierra Solutions, Inc. 1995 Dataset. Results are from surface sediment samples(0 to 0.5 foot)

Radar Plot for Selected Metals
River Mile 3 to River Mile 4

Lower Passaic River Restoration Project

Figure 15-1c

September 2008



Legend

- TSI 240 / RM 4.01
- TSI 241 / RM 4.01
- TSI 242 / RM 4.02
- TSI 289 / RM 4.19
- TSI 243 / RM 4.24
- TSI 244 / RM 4.24
- TSI 245 / RM 4.24
- TSI 290 / RM 4.25
- TSI 291 / RM 4.32
- TSI 292 / RM 4.39
- TSI 292 dup / RM 4.39
- TSI 246 / RM 4.47
- TSI 248 / RM 4.47
- TSI 249 / RM 4.69
- TSI 251 / RM 4.7
- TSI 254 / RM 4.91
- TSI 253 / RM 4.92

Location

River Mile 4 to River Mile 5

Note:
Each metal in the radar plot is represented on its own axis, which radiates from the center point of the graph.Metal concentrations are plotted as a unitless mass fraction [concentration of the metal (ug/kg)/ total concentration (ug/kg)]. For clarity, a logarithmic scale is used. Lines connect all the values from a given sample.

Data Source: Tierra Solutions, Inc. 1995 Dataset. Results are from surface sediment samples(0 to 0.5 foot)

US Army Corps of Engineers

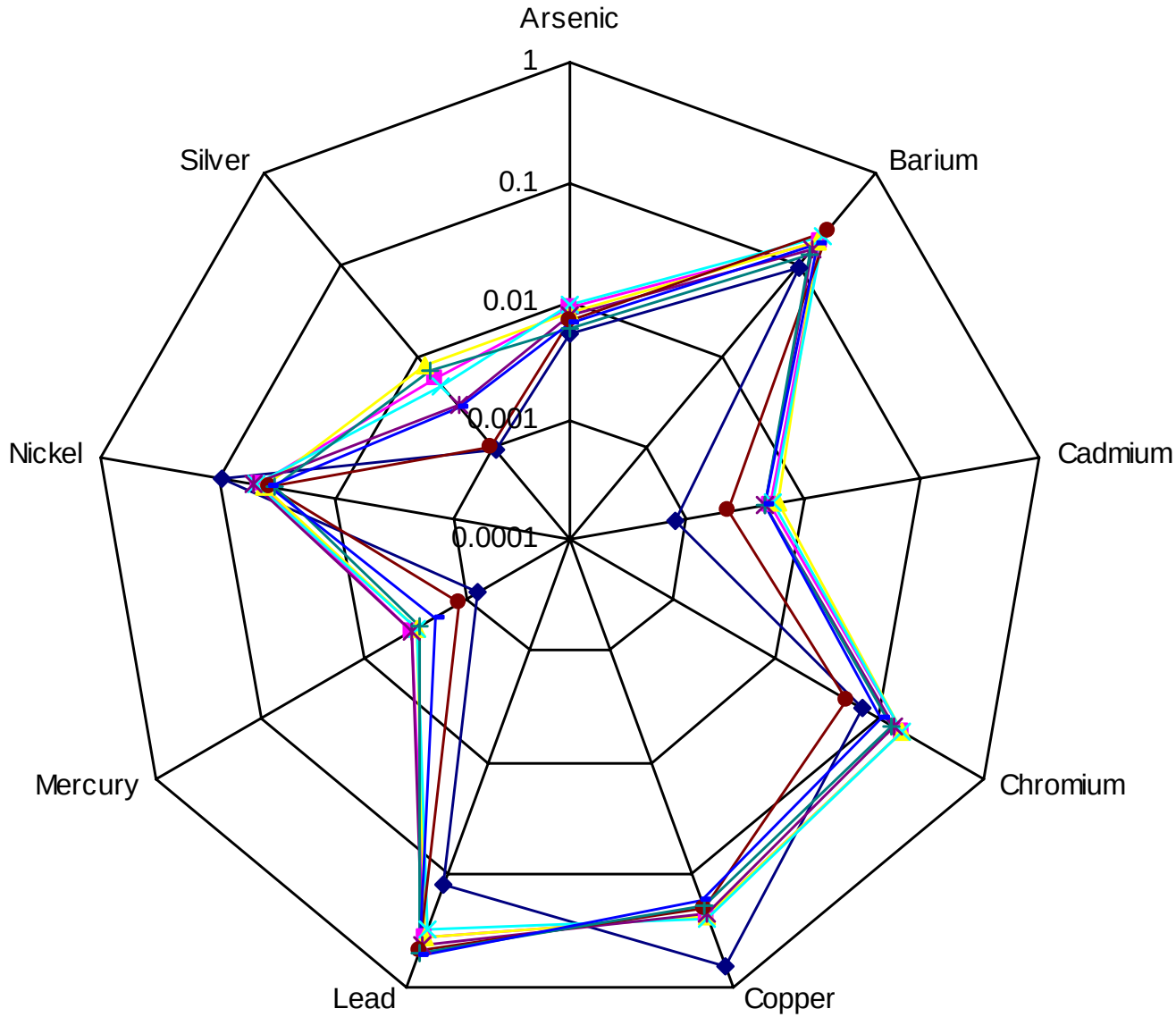
Radar Plot for Selected Metals
River Mile 4 to River Mile 5

Lower Passaic River Restoration Project

Figure 15-1d

September 2008

MALCOLM PIRNIE



Legend

- TSI 293 / RM 5.08
- TSI 255 / RM 5.16
- TSI 257 / RM 5.16
- TSI 258 / RM 5.34
- TSI 263 / RM 5.51
- TSI 267 / RM 5.95
- TSI 268 / RM 5.95
- TSI 269 / RM 5.95

Location

River Mile 5 to River Mile 6

Note:
Each metal in the radar plot is represented on its own axis, which radiates from the center point of the graph.Metal concentrations are plotted as a unitless mass fraction [concentration of the metal (ug/kg)/ total concentration (ug/kg)]. For clarity, a logarithmic scale is used. Lines connect all the values from a given sample.

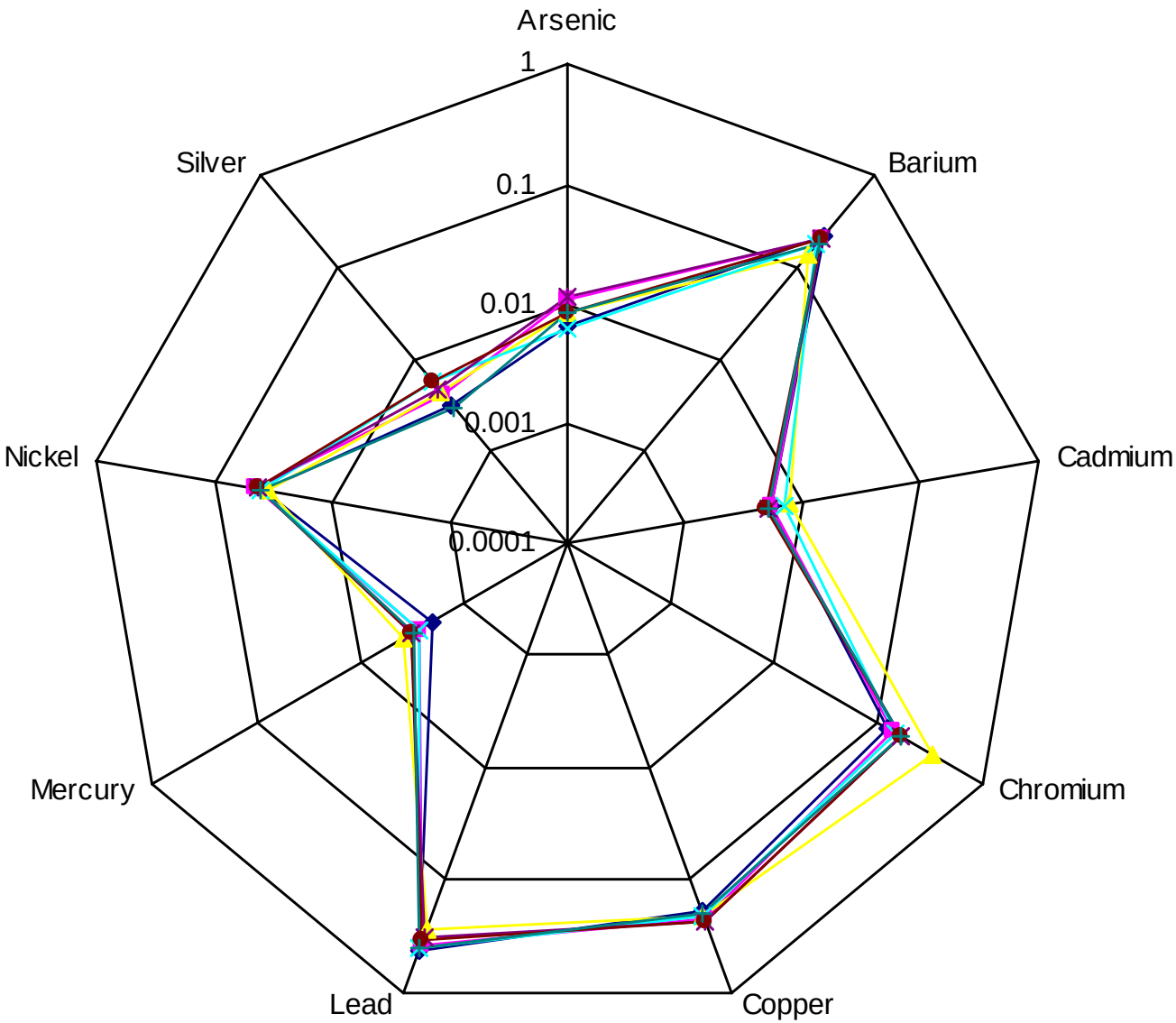
Data Source: Tierra Solutions, Inc. 1995 Dataset. Results are from surface sediment samples(0 to 0.5 foot)

Radar Plot for Selected Metals
River Mile 5 to River Mile 6

Lower Passaic River Restoration Project

Figure 15-1e

September 2008



Legend

- TSI 272 / RM 6.27
- TSI 296 / RM 6.4
- TSI 273 / RM 6.49
- TSI 274 / RM 6.49
- TSI 275 / RM 6.49
- TSI 276 / RM 6.71
- TSI 278 / RM 6.71

Location

River Mile 6 to River Mile 7

Note:
Each metal in the radar plot is represented on its own axis, which radiates from the center point of the graph.Metal concentrations are plotted as a unitless mass fraction [concentration of the metal (ug/kg)/ total concentration (ug/kg)]. For clarity, a logarithmic scale is used. Lines connect all the values from a given sample.

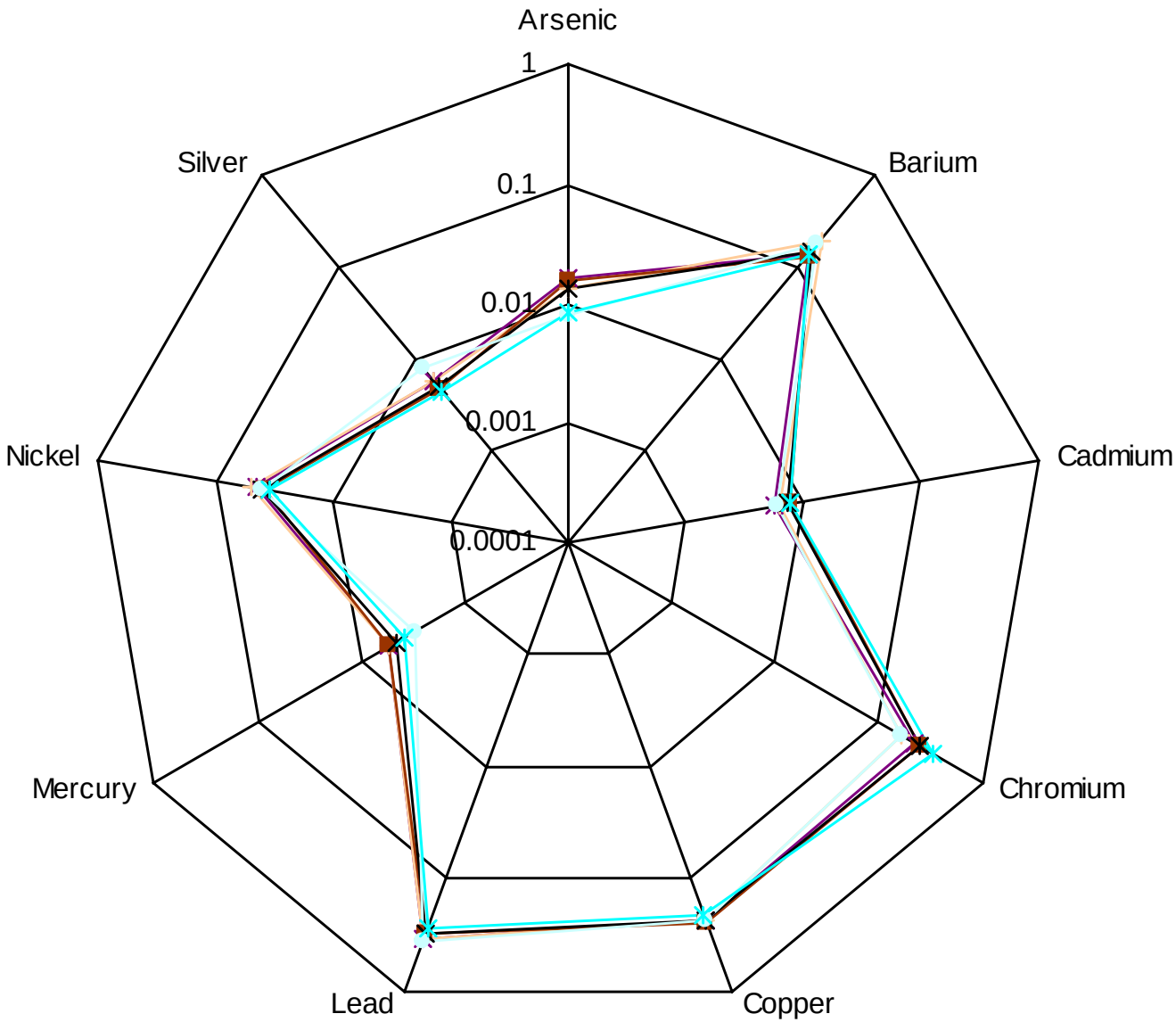
Data Source: Tierra Solutions, Inc. 1995 Dataset. Results are from surface sediment samples(0 to 0.5 foot)

Radar Plot for Selected Metals
River Mile 6 to River Mile 7

Lower Passaic River Restoration Project

Figure 15-1f

September 2008



Legend

- TSI 206 / RM 1.23
- TSI 226 / RM 2.88
- TSI 237 / RM 3.78
- TSI 240 / RM 4.01
- TSI 257 / RM 5.16
- TSI 273 / RM 6.49

Location

River Mile 1 to River Mile 7

Note:
Each metal in the radar plot is represented on its own axis, which radiates from the center point of the graph.Metal concentrations are plotted as a unitless mass fraction [concentration of the metal (ug/kg)/ total concentration (ug/kg)]. For clarity, a logarithmic scale is used. Lines connect all the values from a given sample.

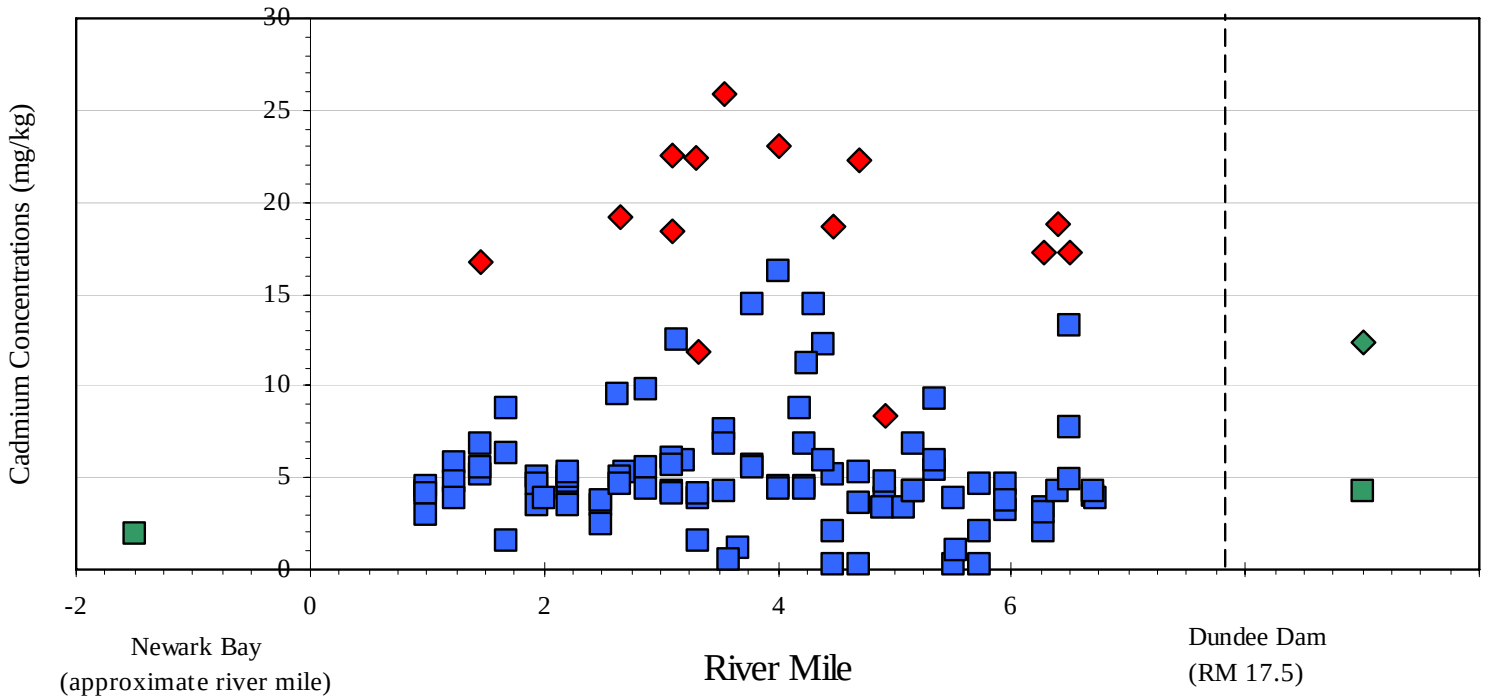
Data Source: Tierra Solutions, Inc. 1995 Dataset. Results are from surface sediment samples(0 to 0.5 foot)

Radar Plot for Selected Metals
River Mile 1 to River Mile 7

Lower Passaic River Restoration Project

Figure 15-1g

September 2008



Legend

- Tierra Solutions, Inc. (1963)
- Tierra Solutions, Inc. (1995)
- Bopp et al., 2006 (1963)
- Bopp et al., 2006 (1986-1995)

Location

Notes

Tierra Solutions Inc. Data Source:
PASSAIC 1995 RI Sampling Program (14 of the 95 locations for1963; all locations for 1995), Tierra Solutions, Inc. 1963 concentrations were calculated via interpolation at the depth corresponding to the cesium-137 peak

Surface concentrations are from a depth of 0 to <1 foot

Non-detect (lab qualifier containing a U) plotted as half the reported value

Bopp et al,. 2006 Data Source:
Contaminant Chronologies from Hudson River Sedimentary Records, Bopp et al.

Concentration at 1963 obtained from analysis of discrete core sections corresponding to the cesium-137 peak.

Surface concentrations are from a depth of 0 to <1 foot

US Army Corps of Engineers®

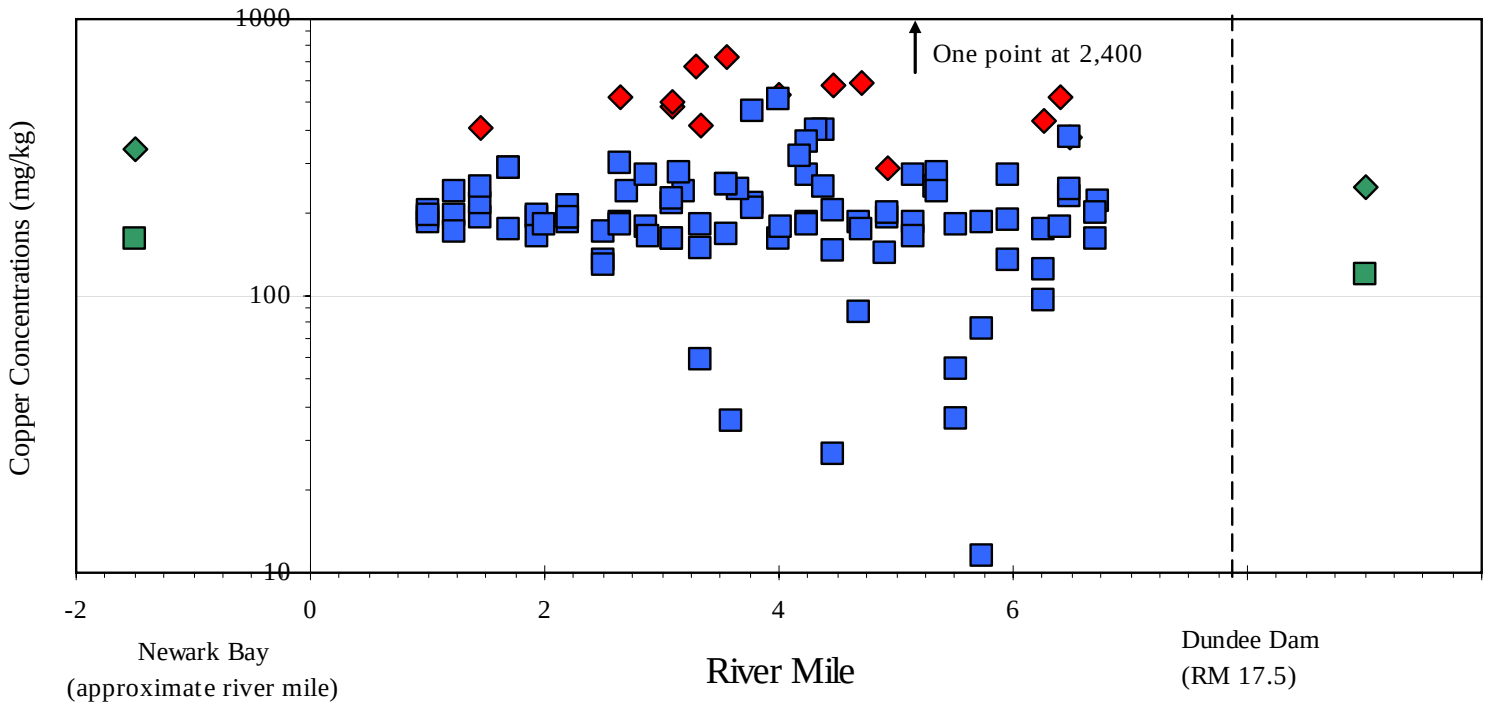
Comparison of Concentrations ca 1963 and 1986-1995: Cadmium

Lower Passaic River Restoration Project

Figure 15-2a

September 2008

MALCOLM PIRNIE



Legend

- Tierra Solutions, Inc. (1963)
- Tierra Solutions, Inc. (1995)
- Bopp et al., 2006 (1963)
- Bopp et al., 2006 (1986-1995)

Location

Notes

Tierra Solutions Inc. Data Source:
PASSAIC 1995 RI Sampling Program (14 of the 95 locations for1963; all locations for 1995), Tierra Solutions, Inc. 1963 concentrations were calculated via interpolation at the depth corresponding to the cesium-137 peak

Surface concentrations are from a depth of 0 to <1 foot

Non-detect (lab qualifier containing a U) plotted as half the reported value

Bopp et al,. 2006 Data Source:
Contaminant Chronologies from Hudson River Sedimentary Records, Bopp et al.

Concentration at 1963 obtained from analysis of discrete core sections corresponding to the cesium-137 peak.

Surface concentrations are from a depth of 0 to <1 foot

US Army Corps of Engineers®

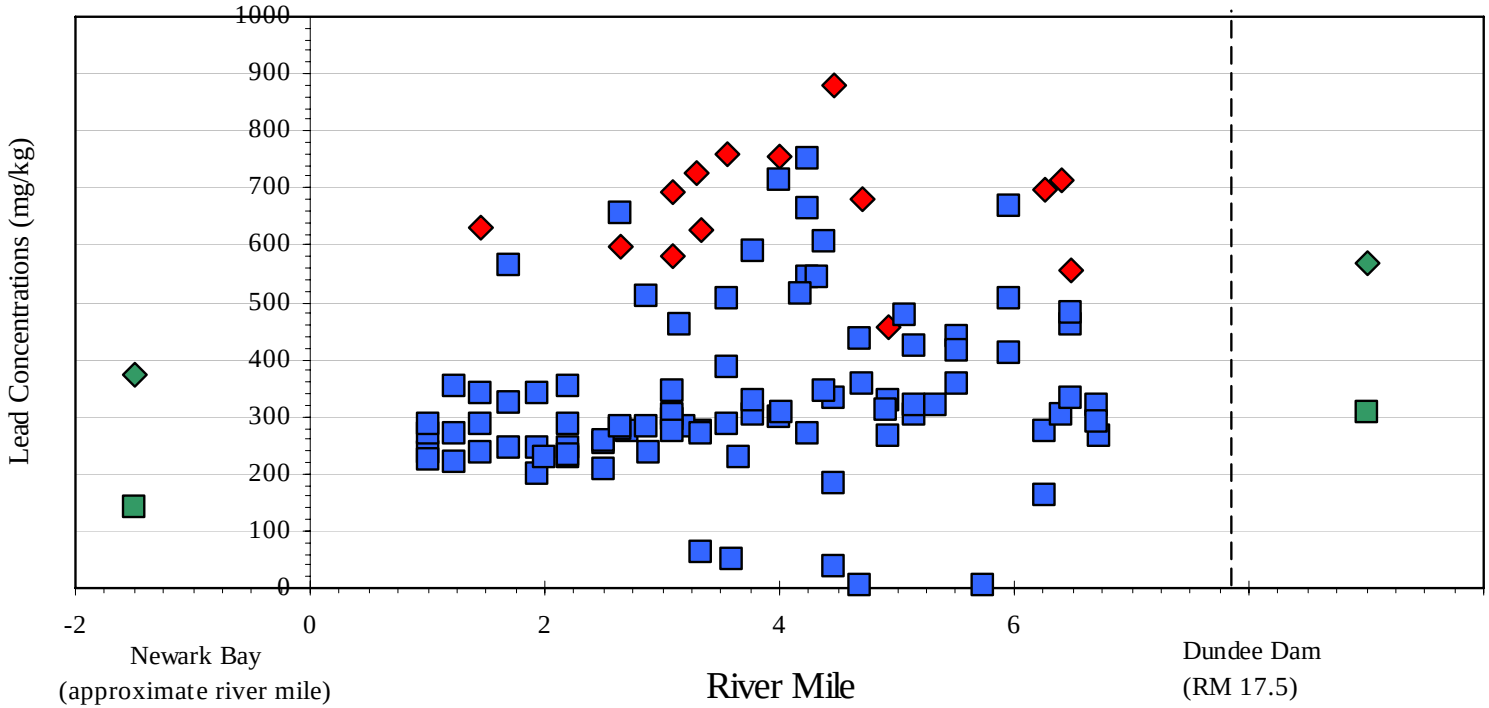
Comparison of Concentrations ca 1963 and 1986-1995: Copper

Lower Passaic River Restoration Project

Figure 15-2b

September 2008

MALCOLM PIRNIE



Legend

- Tierra Solutions, Inc. (1963)
- Tierra Solutions, Inc. (1995)
- Bopp et al., 2006 (1963)
- Bopp et al., 2006 (1986-1995)

Location

Notes

Tierra Solutions Inc. Data Source:
PASSAIC 1995 RI Sampling Program (14 of the 95 locations for1963; all locations for 1995), Tierra Solutions, Inc. 1963 concentrations were calculated via interpolation at the depth corresponding to the cesium-137 peak

Surface concentrations are from a depth of 0 to <1 foot

Non-detect (lab qualifier containing a U) plotted as half the reported value

Bopp et al,. 2006 Data Source:
Contaminant Chronologies from Hudson River Sedimentary Records, Bopp et al.

Concentration at 1963 obtained from analysis of discrete core sections corresponding to the cesium-137 peak.

Surface concentrations are from a depth of 0 to <1 foot

US Army Corps of Engineers®

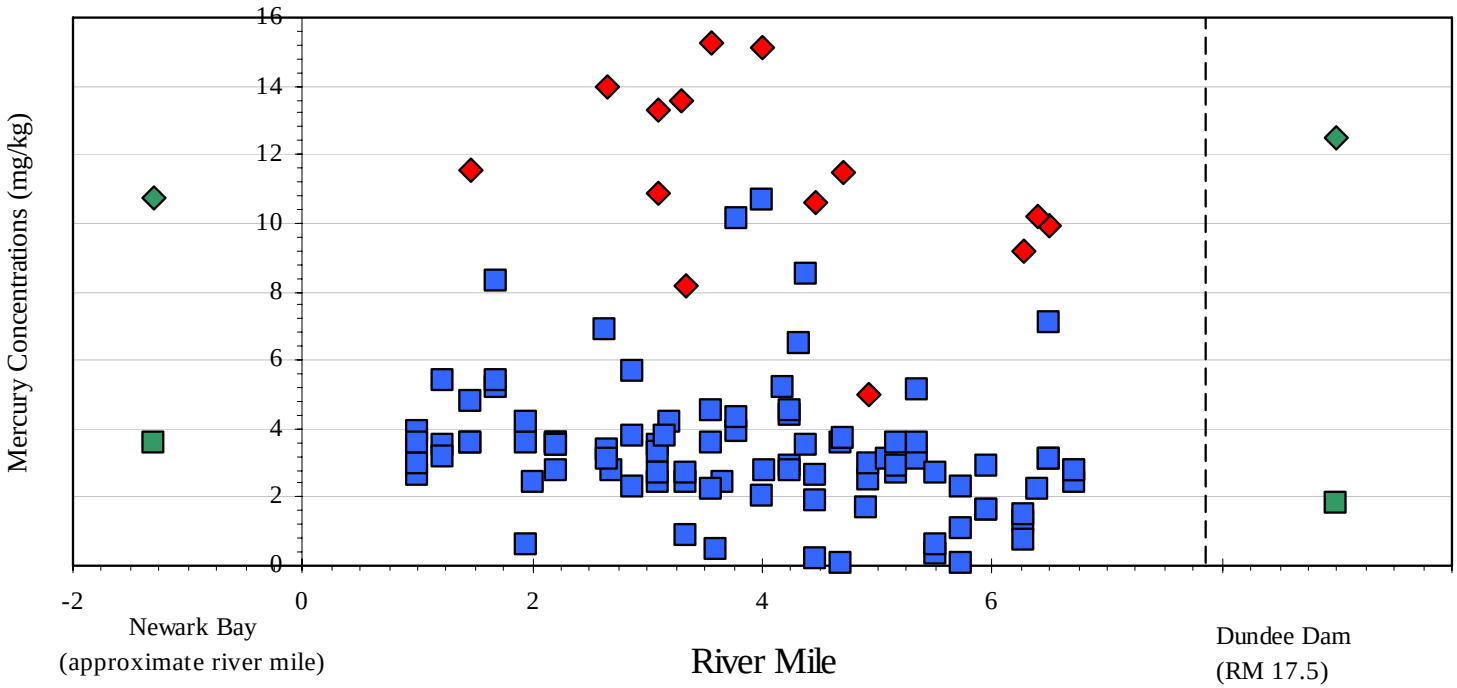
Comparison of Concentrations ca 1963 and 1986-1995: Lead

Lower Passaic River Restoration Project

Figure 15-2c

September 2008

MALCOLM PIRNIE



Legend

- Tierra Solutions, Inc. (1963)
- Tierra Solutions, Inc. (1995)
- Bopp et al., 2006 (1963)
- Bopp et al., 2006 (1986-1995)

Location

Notes

Tierra Solutions Inc. Data Source:
PASSAIC 1995 RI Sampling Program (14 of the 95 locations for1963; all locations for 1995), Tierra Solutions, Inc. 1963 concentrations were calculated via interpolation at the depth corresponding to the cesium-137 peak

Surface concentrations are from a depth of 0 to <1 foot

Non-detect (lab qualifier containing a U) plotted as half the reported value

Bopp et al,. 2006 Data Source:
Contaminant Chronologies from Hudson River Sedimentary Records, Bopp et al.

Concentration at 1963 obtained from analysis of discrete core sections corresponding to the cesium-137 peak.

Surface concentrations are from a depth of 0 to <1 foot

US Army Corps of Engineers®

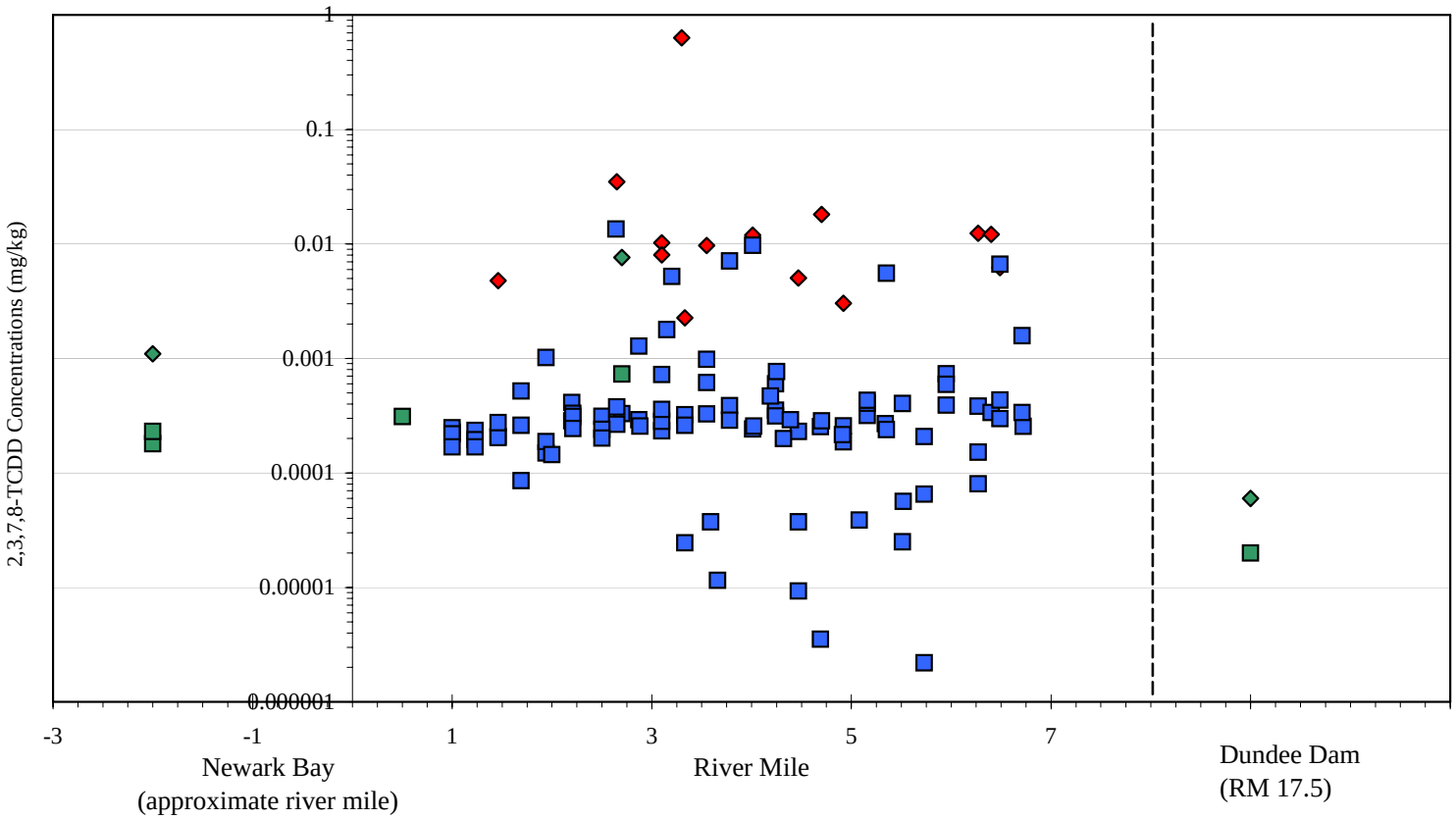
Comparison of Concentrations ca 1963 and 1986-1995: Mercury

Lower Passaic River Restoration Project

Figure 15-2d

September 2008

MALCOLM PIRNIE



Legend

- Tierra Solutions, Inc. (1963)
- Tierra Solutions, Inc. (1995)
- Bopp et al., 1991a, 1991b (1963)
- Bopp et al., 1991a, 1991b (1985-1986)

Location

Notes

Tierra Solutions Inc. Data Source:
PASSAIC 1995 RI Sampling Program (14 of the 95 locations), Tierra Solutions, Inc.

Interpolated concentrations calculated at the depth corresponding to the cesium-137 peak

Non-detect (lab qualifier containing a U) plotted as half the reported detection limit

Surface concentrations are from a depth of 0 to <1 foot

Bopp et al,. 1991a Data Source:
Sediment Sampling and Radionuclide and Chlorinated Hydrocarbon Analysis in Newark Bay and the Hackensack and Passaic Rivers, Bopp et al.

Bopp et al., 1991b Data Source:
EST 25(J): 951 - 956.

Non-detect (reported as 60 ng/kg) above Dundee Dam plotted as 0.00006 ug/kg

Surface concentrations are from a depth of 0 to <1 foot

US Army Corps of Engineers®

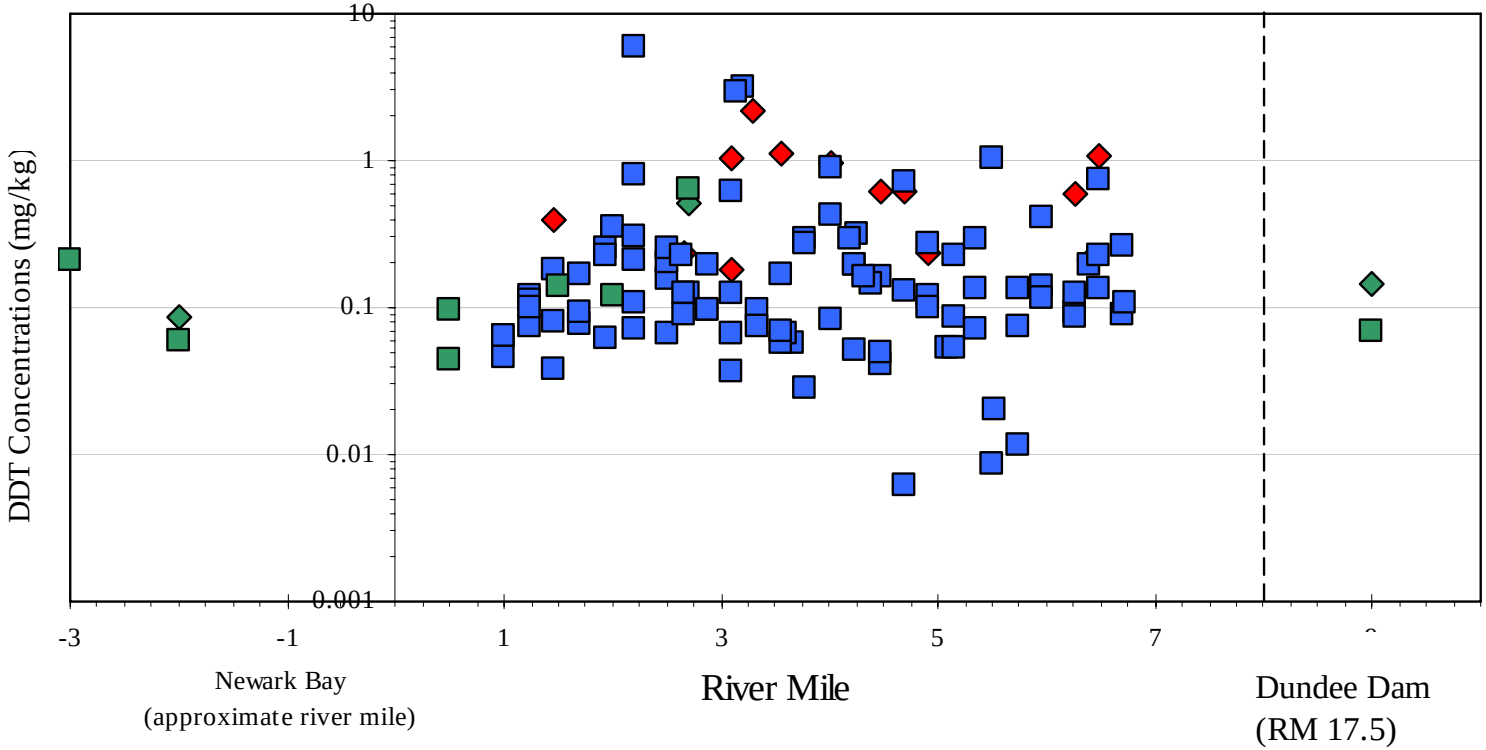
Comparison of 2,3,7,8-TCDD Concentrations in 1963, 1985, 1986, and 1995

Lower Passaic River Restoration Project

Figure 15-2e

September 2008

MALCOLM PIRNIE



Legend

- Tierra Solutions, Inc. (1963)
- Tierra Solutions, Inc. (1995)
- Bopp et al., 1991a (1963)
- Bopp et al., 1991a (1985-1986)

Location

Notes

Tierra Solutions Inc. Data Source:
PASSAIC 1995 RI Sampling Program (14 of the 95 locations), Tierra Solutions, Inc.

Interpolated concentrations calculated at the depth corresponding to the cesium-137 peak

Total DDT represents the sum of the three 4,4' isomers wherever possible.

Nondetected values were incorporated into the sum as half the reported detection limit.

Surface concentrations are from a depth of 0 to <1 foot

Bopp et. al., 1991a Data Source:
Sediment Sampling and Radionuclide and Chlorinated Hydrocarbon Analysis in Newark Bay and the Hackensack and Passaic Rivers, Bopp et al.

Concentration obtained from analysis of discrete core sections corresponding to the cesium-137 peak.

Total DDT represents the sum of two of the three 4,4' isomers (DDD and DDT).

Surface concentrations are from a depth of 0 to <1 foot

US Army Corps of Engineers®

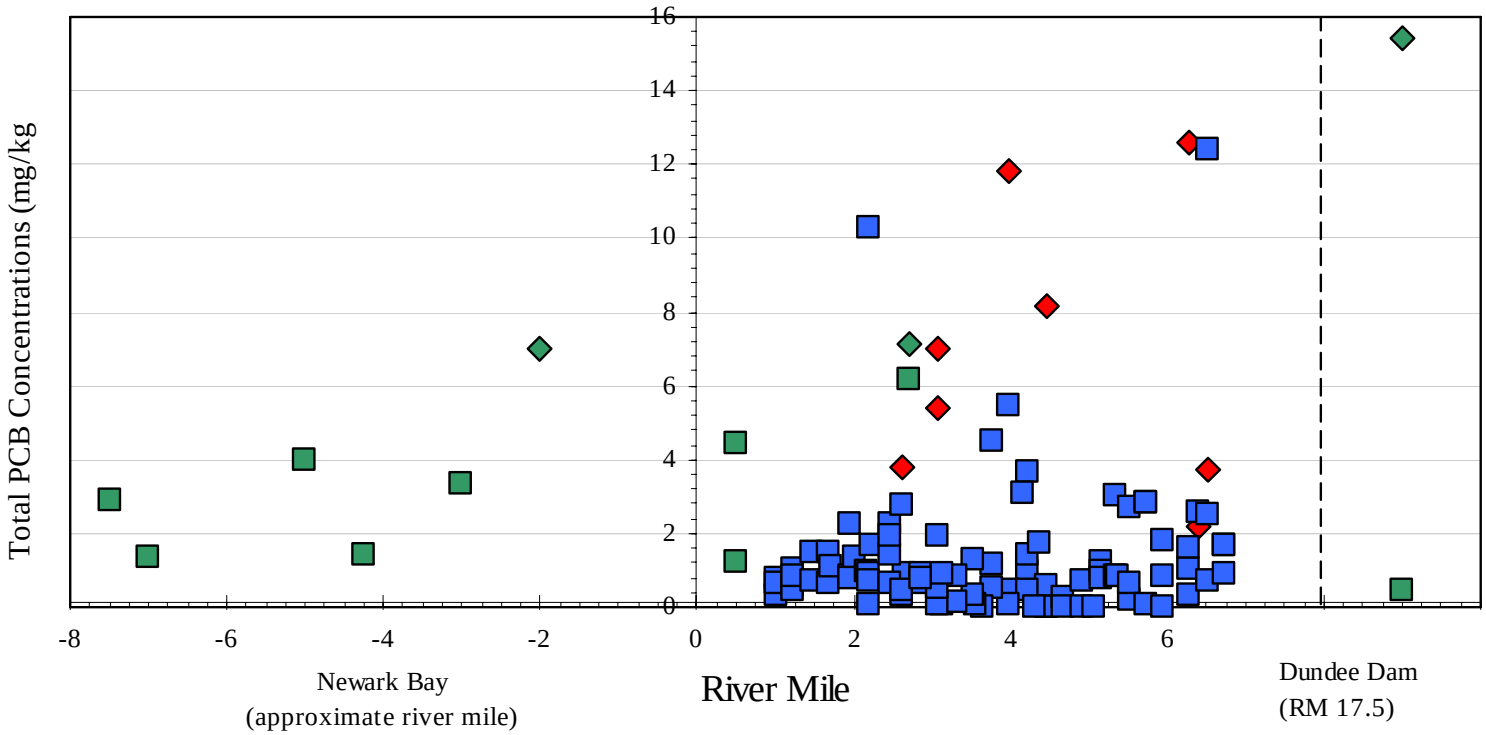
Comparison of Total DDT Concentrations in 1963, 1985, 1986, and 1995

Lower Passaic River Restoration Project

Figure 15-2f

September 2008

MALCOLM PIRNIE



Legend

- Tierra Solutions, Inc (1963)
- Tierra Solutions, Inc. (1995)
- Bopp et al., 1991a (1963)
- Bopp er al., 1991a (1985-1986)

Location

Notes

Tierra Solutions Inc. Data Source:
PASSAIC 1995 RI Sampling Program (14 of the 95 locations), Tierra Solutions, Inc.

Interpolated concentrations calculated at the depth corresponding to the cesium-137 peak

Non-detect (lab qualifier containing a U) plotted as half the reported detection limit

Total PCB values are the sum of Aroclors 1248, 1254, and 1260

Bopp et al,. 1991a Data Source:
Sediment Sampling and Radionuclide and Chlorinated Hydrocarbon Analysis in Newark Bay and the Hackensack and Passaic Rivers, Bopp et al.

Concentration obtained from analysis of discrete core sections corresponding to the cesium-137 peak.

Total PCB concentrations are the sum of Aroclors 1242 and 1254.

US Army Corps of Engineers®

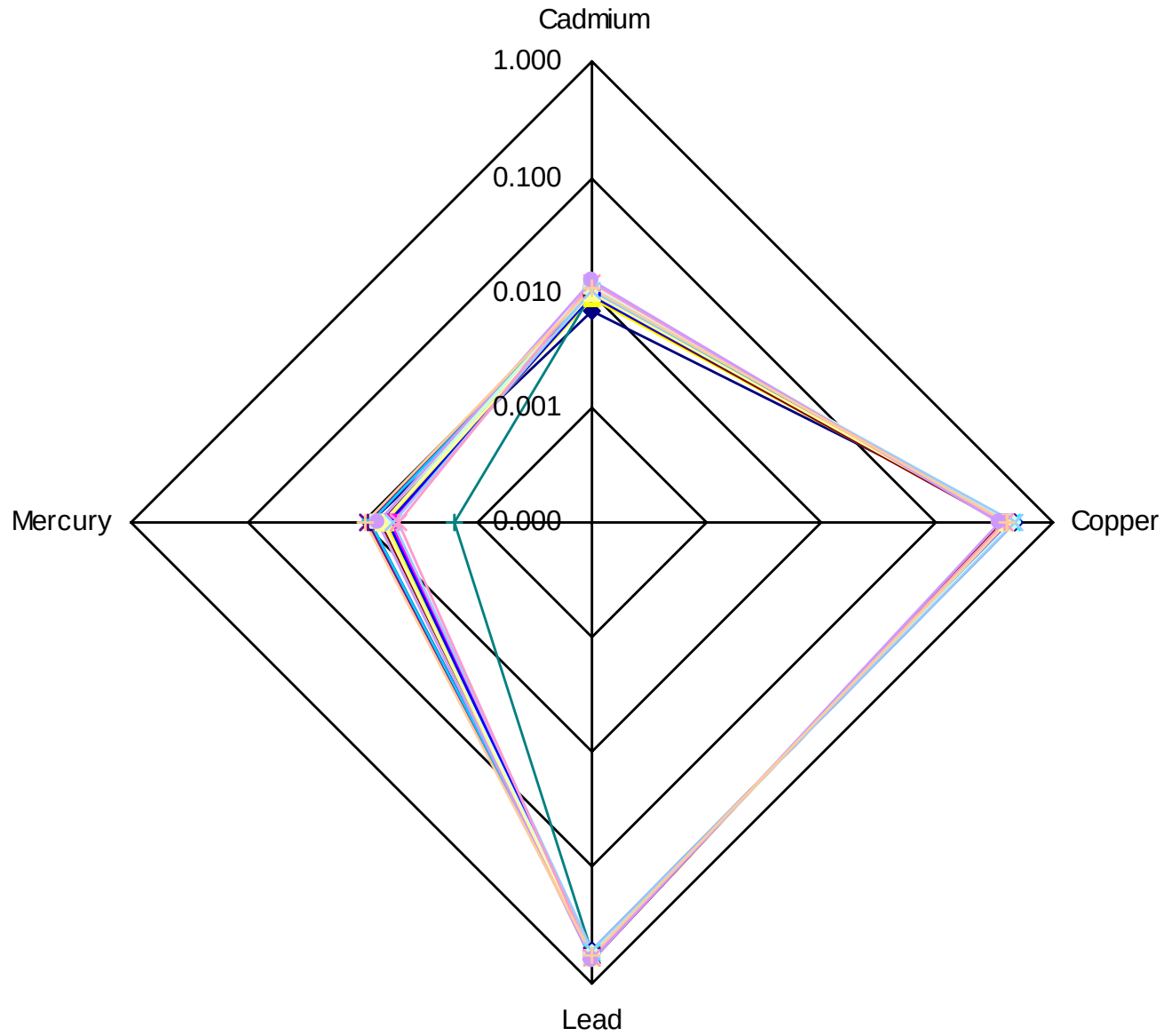
Comparison of Total PCB Concentrations in 1963, 1985, 1986, and 1995

Lower Passaic River Restoration Project

Figure 15-2g

September 2008

MALCOLM PIRNIE



Legend

- TSI 201 / RM 1
- TSI 202 / RM 1
- TSI 202 dup / RM 1
- TSI 203 / RM 1
- TSI 206 / RM 1.23
- TSI 213 / RM 1.94
- TSI 214 / RM 1.94
- TSI 295 / RM 2
- TSI 282 / RM 2.2
- TSI 283 / RM 2.2
- TSI 222 / RM 2.65
- TSI 223 / RM 2.65
- TSI 284 / RM 2.7
- TSI 225 / RM 2.87
- TSI 227 / RM 2.87
- TSI 226 / RM 2.88

Location

River Mile 1 to River Mile 3

Notes

Each metal in the radar plot is represented on its own axis, which radiates from the center point of the graph. Metal concentrations are plotted as a unitless mass fraction [concentration of the metal (ug/kg)/ total concentration (ug/kg)]. For clarity, a logarithmic scale is used. Lines connect all the values from a given sample.

Data Source:
Tierra Solutions, Inc. 1995 Dataset. Results are from surface sediment samples (0 to 0.5 foot)

US Army Corps of Engineers®

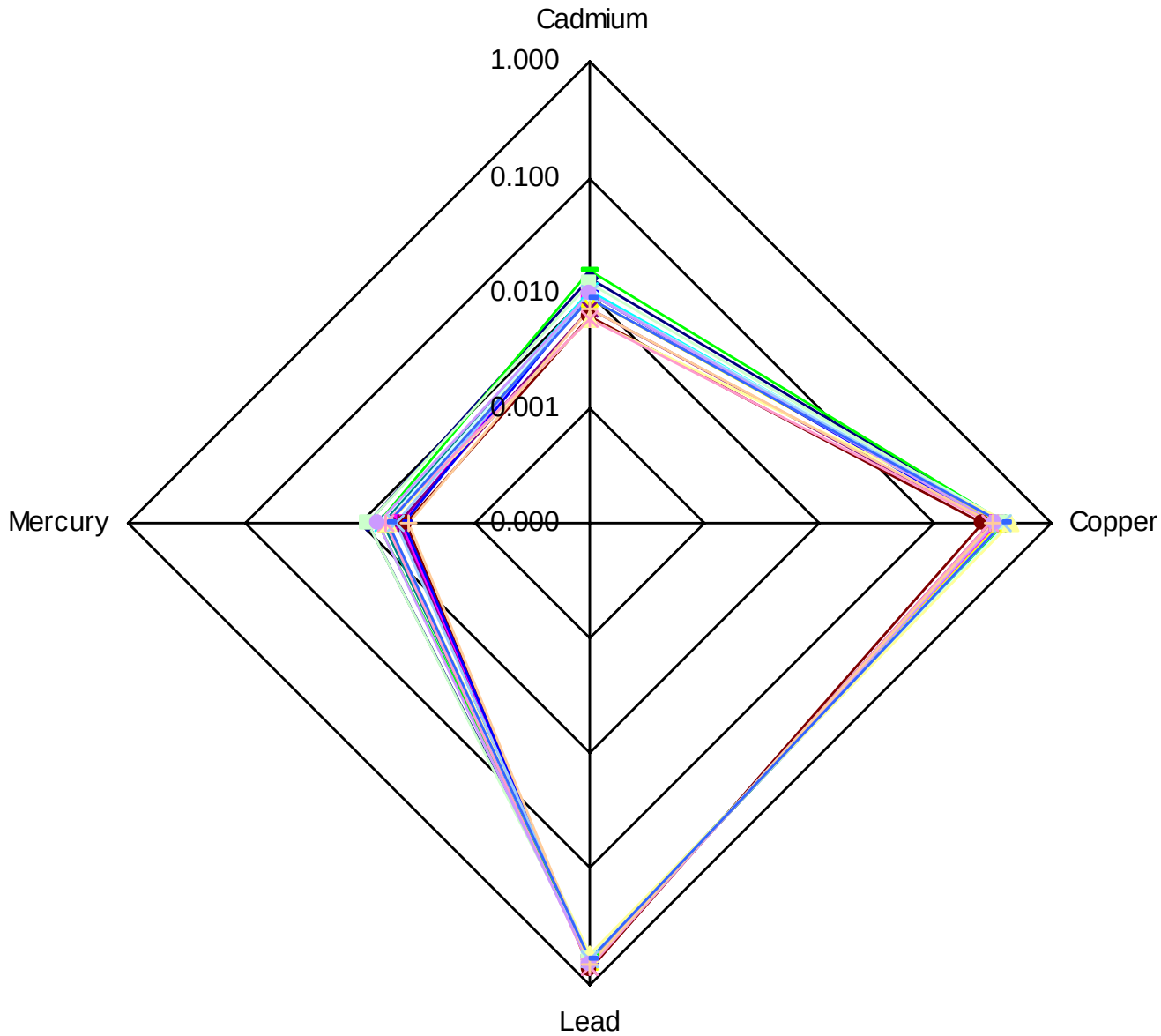
Radar Plot for Cadmium, Copper, Lead, and Mercury, River Mile 1 to River Mile 3

Lower Passaic River Restoration Project

Figure 15-3a

September 2008

MALCOLM PIRNIE



Legend

- TSI 240 / RM 4.01
- TSI 241 / RM 4.01
- TSI 242 / RM 4.02
- TSI 289 / RM 4.19
- TSI 243 / RM 4.24
- TSI 244 / RM 4.24
- TSI 245 / RM 4.24
- TSI 290 / RM 4.25
- TSI 291 / RM 4.32
- TSI 292 / RM 4.39
- TSI 292 dup / RM 4.39
- TSI 246 / RM 4.47
- TSI 248 / RM 4.47
- TSI 249 / RM 4.69
- TSI 251 / RM 4.7
- TSI 254 / RM 4.91
- TSI 253 / RM 4.92

Location

River Mile 4 to River Mile 5

Notes

Each metal in the radar plot is represented on its own axis, which radiates from the center point of the graph. Metal concentrations are plotted as a unitless mass fraction [concentration of the metal (ug/kg)/ total concentration (ug/kg)]. For clarity, a logarithmic scale is used. Lines connect all the values from a given sample.

Data Source:
Tierra Solutions, Inc. 1995 Dataset. Results are from surface sediment samples (0 to 0.5 foot)

US Army Corps of Engineers®

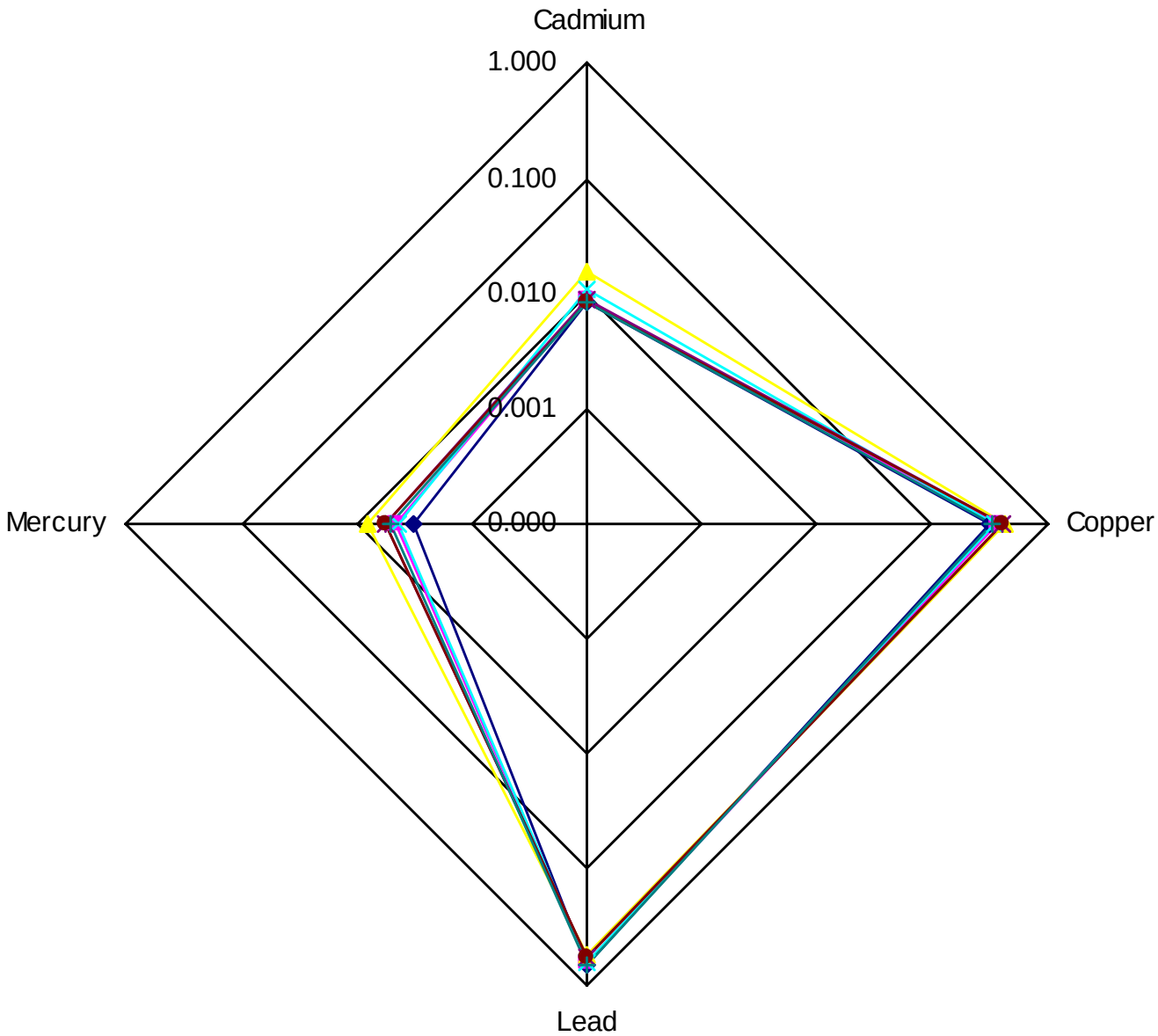
Radar Plot for Cadmium, Copper, Lead, and Mercury, River Mile 4 to River Mile 5

Lower Passaic River Restoration Project

Figure 15-3b

September 2008

MALCOLM PIRNIE



Legend

- TSI 272 / RM 6.27
- TSI 296 / RM 6.4
- TSI 273 / RM 6.49
- TSI 274 / RM 6.49
- TSI 275 / RM 6.49
- TSI 276 / RM 6.71
- TSI 278 / RM 6.71

Location

River Mile 6 to River Mile 7

Notes

Each metal in the radar plot is represented on its own axis, which radiates from the center point of the graph. Metal concentrations are plotted as a unitless mass fraction [concentration of the metal (ug/kg)/ total concentration (ug/kg)]. For clarity, a logarithmic scale is used. Lines connect all the values from a given sample.

Data Source:
Tierra Solutions, Inc. 1995 Dataset. Results are from surface sediment samples (0 to 0.5 foot)

US Army Corps of Engineers

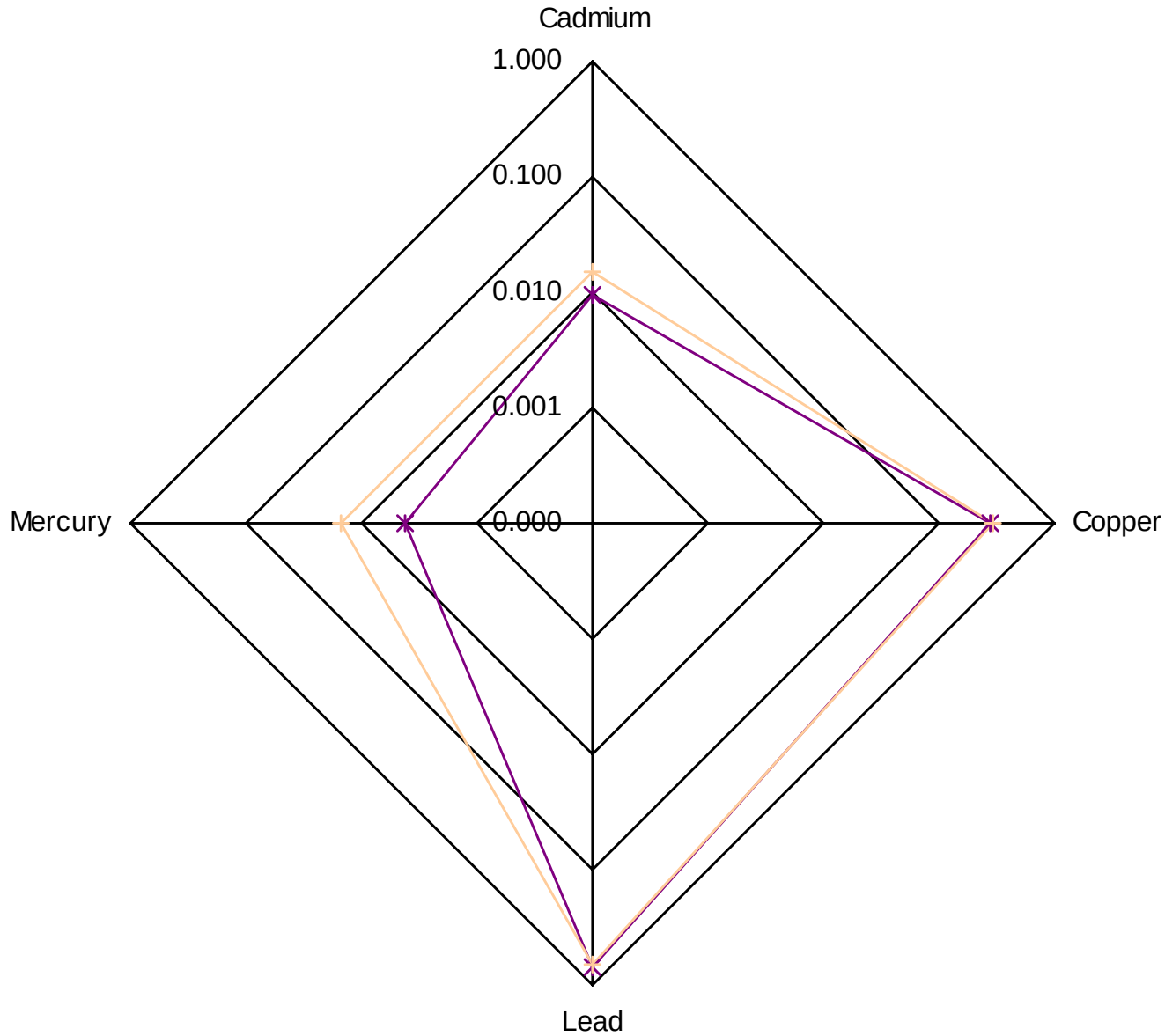
Radar Plot for Cadmium, Copper, Lead, and Mercury, River Mile 6 to River Mile 7

Lower Passaic River Restoration Project

Figure 15-3c

September 2008

MALCOLM PIRNIE



Legend

1963 Dundee Dam

1986 Dundee Dam

Location

Dundee Dam

Notes

Each metal in the radar plot is represented on its own axis, which radiates from the center point of the graph. Metal concentrations are plotted as a unitless mass fraction [concentration of the metal (ug/kg)/ total concentration (ug/kg)]. For clarity, a logarithmic scale is used. Lines connect all the values from a given sample.

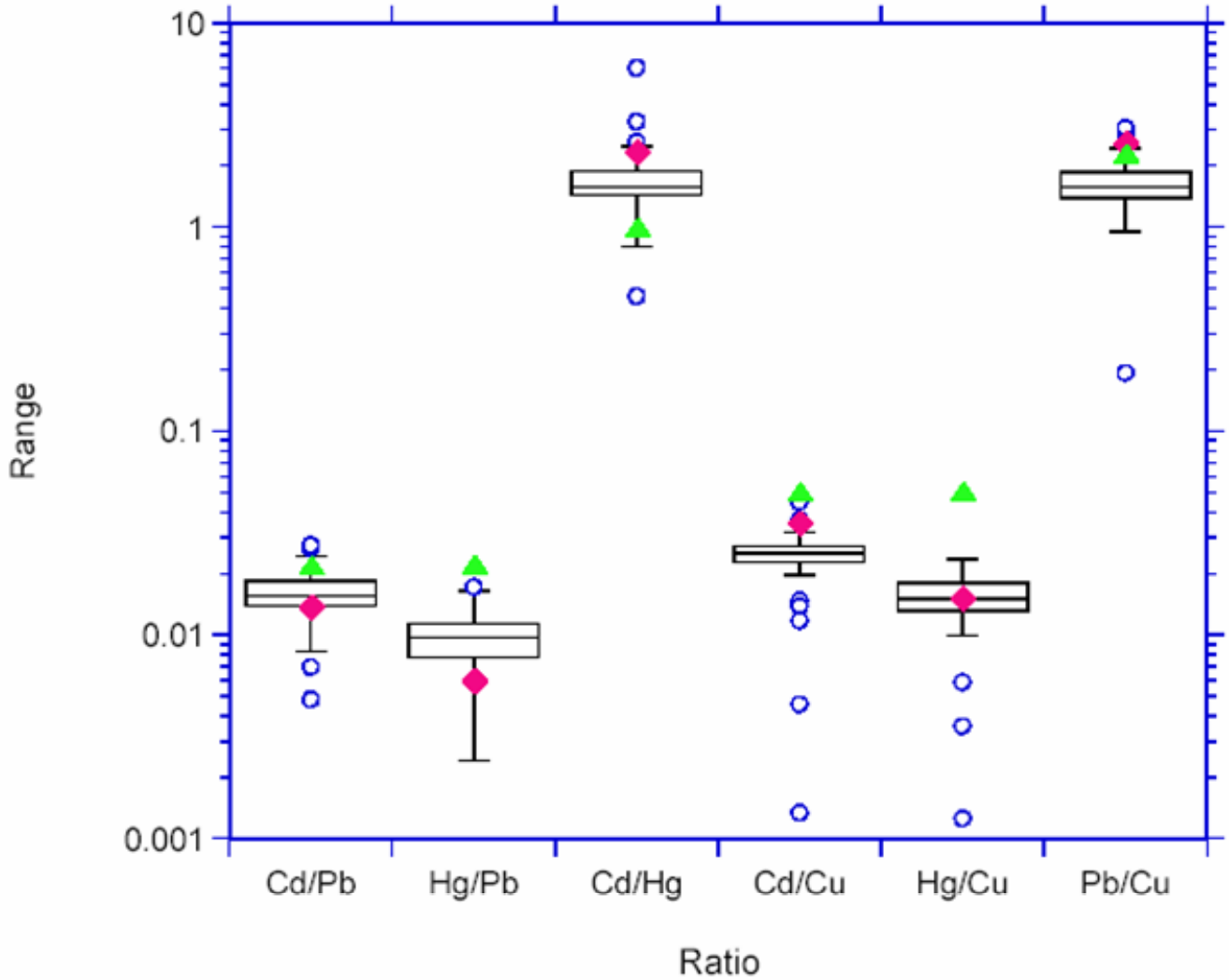
Data Source:
Tierra Solutions, Inc. 1995 Dataset. Results are from surface sediment samples (0 to 0.5 foot)

Radar Plot for Cadmium, Copper, Lead, and Mercury, Dundee Dam

Lower Passaic River Restoration Project

Figure 15-3d

September 2008



Legend

Dundee Dam

1963

1986

Lower Passaic

Outlier

Predicted Upper Bound

Upper Quartile

Median

Lower Quartile

Predicted Lower Bound

Location

Notes

US Army Corps of Engineers

Metal Ratios in Passaic River Sediments

Lower Passaic River Restoration Project

Figure 15-4

September 2008

MALCOLM PIRNIE

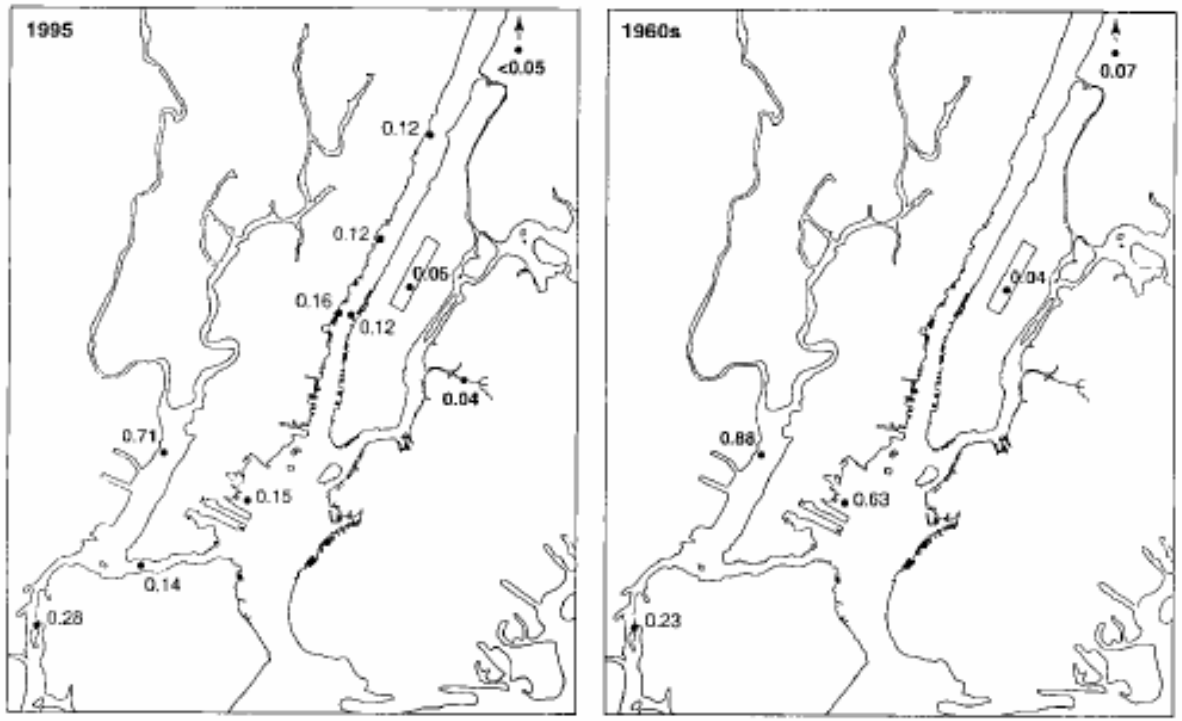


Figure 2.32: 2,3,7,8-TeCDD/ΣTeCDD ratio for harbor sediments deposited in 1995±1 year (left) and in the mid-1960s (right). Data for the mp59.55i "upstream" indicator sample is noted with an arrow at top right. The ratios in atmospheric deposition measured in the Central Park Lake sediments and in "upstream" sediment delivery measured in the mp59.55i core are low in both time periods. The influence of the Western Harbor (80 Lister Avenue) source on Harbor sediments was much stronger in the 1960s, but is still responsible for ca. 50% of 2,3,7,8-TeCDD in recent deposition.

Legend

Location

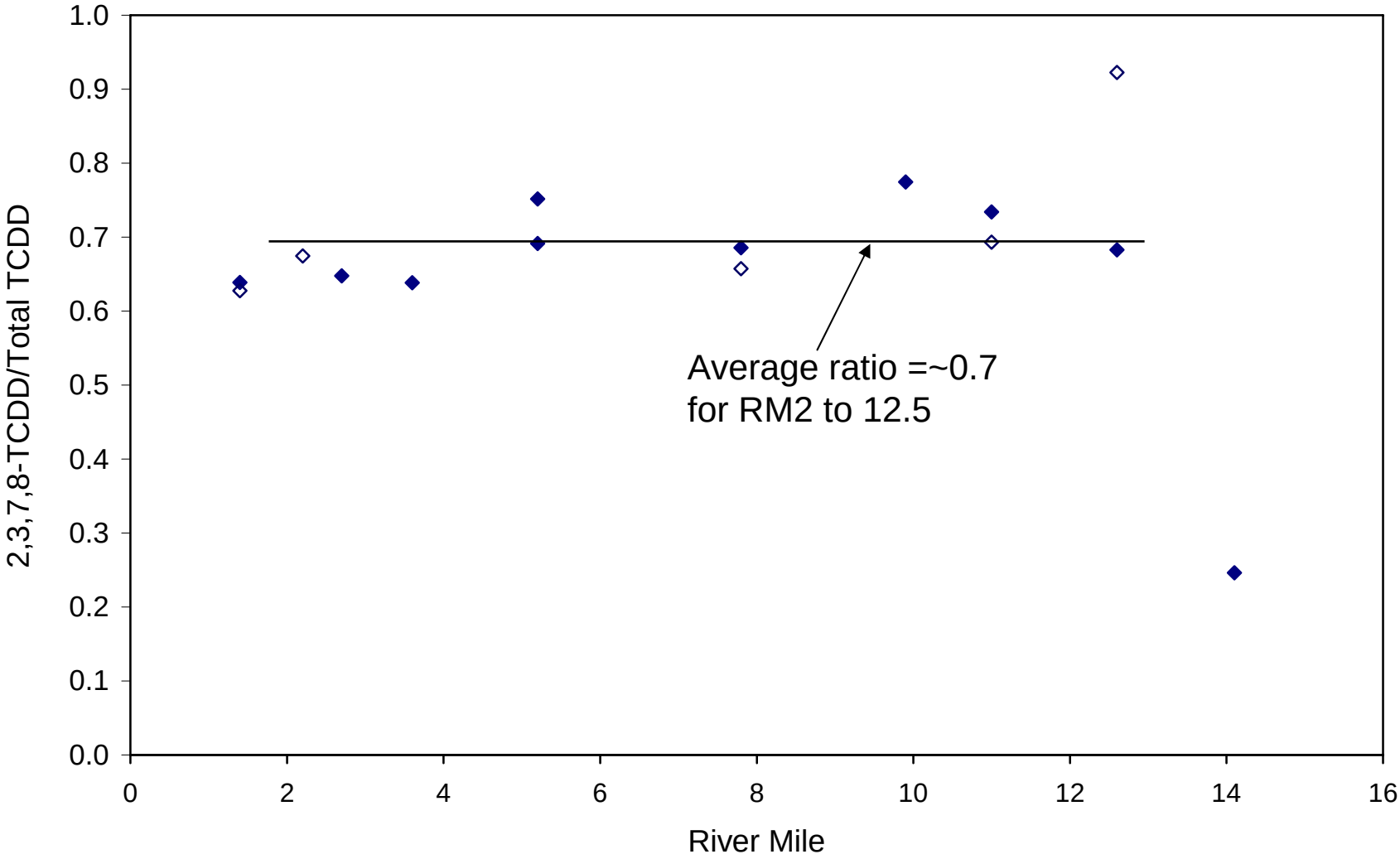
Notes

Reprint from D.A. Chaky (2003) "Polychlorinated biphenyls, polychlorinated dibenzo-p-dioxins, and furans in the NY Metropolitan Area." Rensselaer Polytechnic Institute (Troy, NY).

Lower Passaic River Restoration Project

Figure 15-5

September 2008

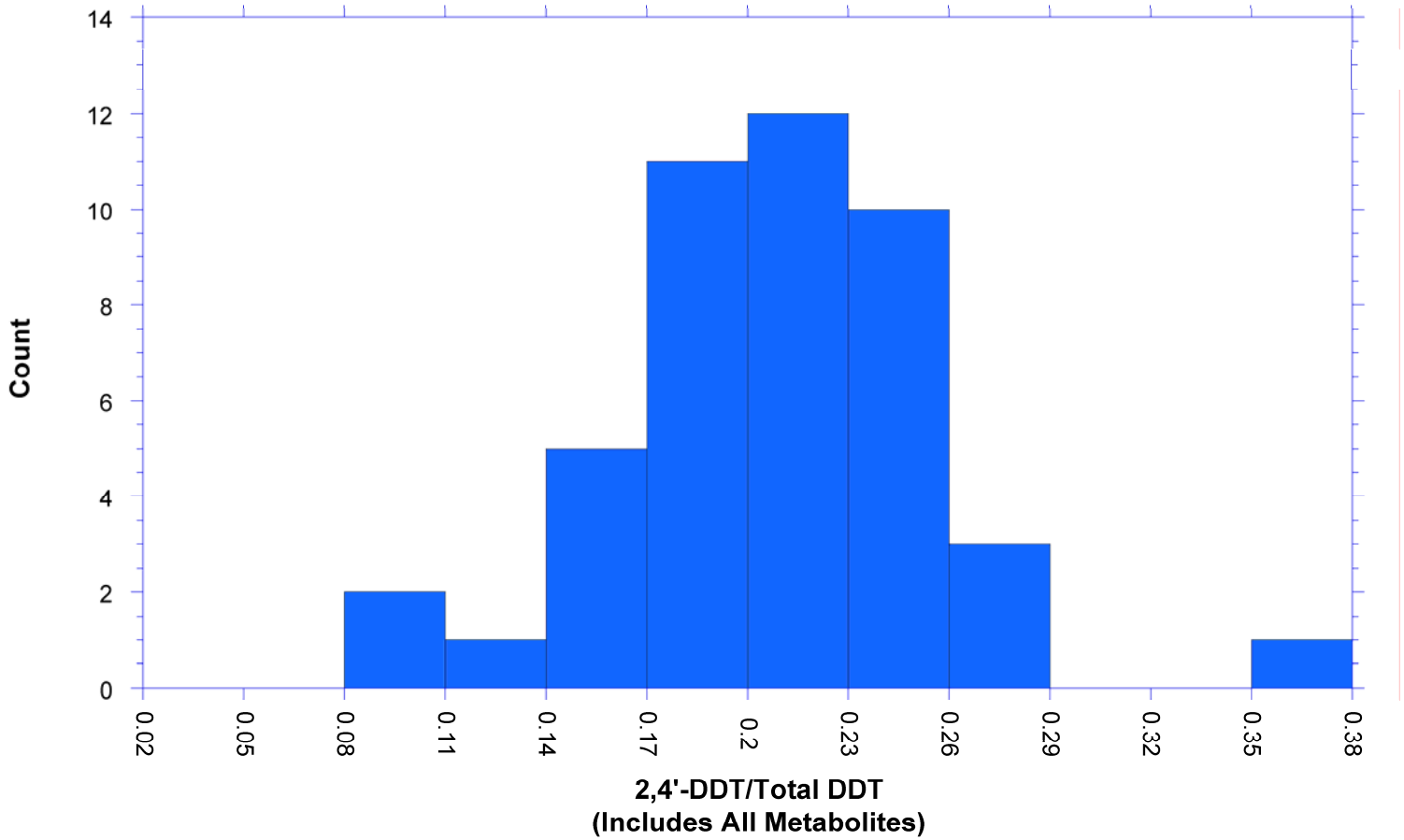


2,3,7,8-TCDD to Total TCDD Ratio
2005-2008 Surface Sediment

Lower Passaic River Restoration Project

Figure 15-6

September 2008



Legend

Location

Notes

Data Source:
NOAA NS&T
Hudson-Raritan Phase II, 1993

Sample size: 45 surface sediment samples

Ratio estimated as (Total DDT - 4,4'-series)/ Total DDT because 2,4"-DDT metabolites were not reported

US Army Corps of Engineers

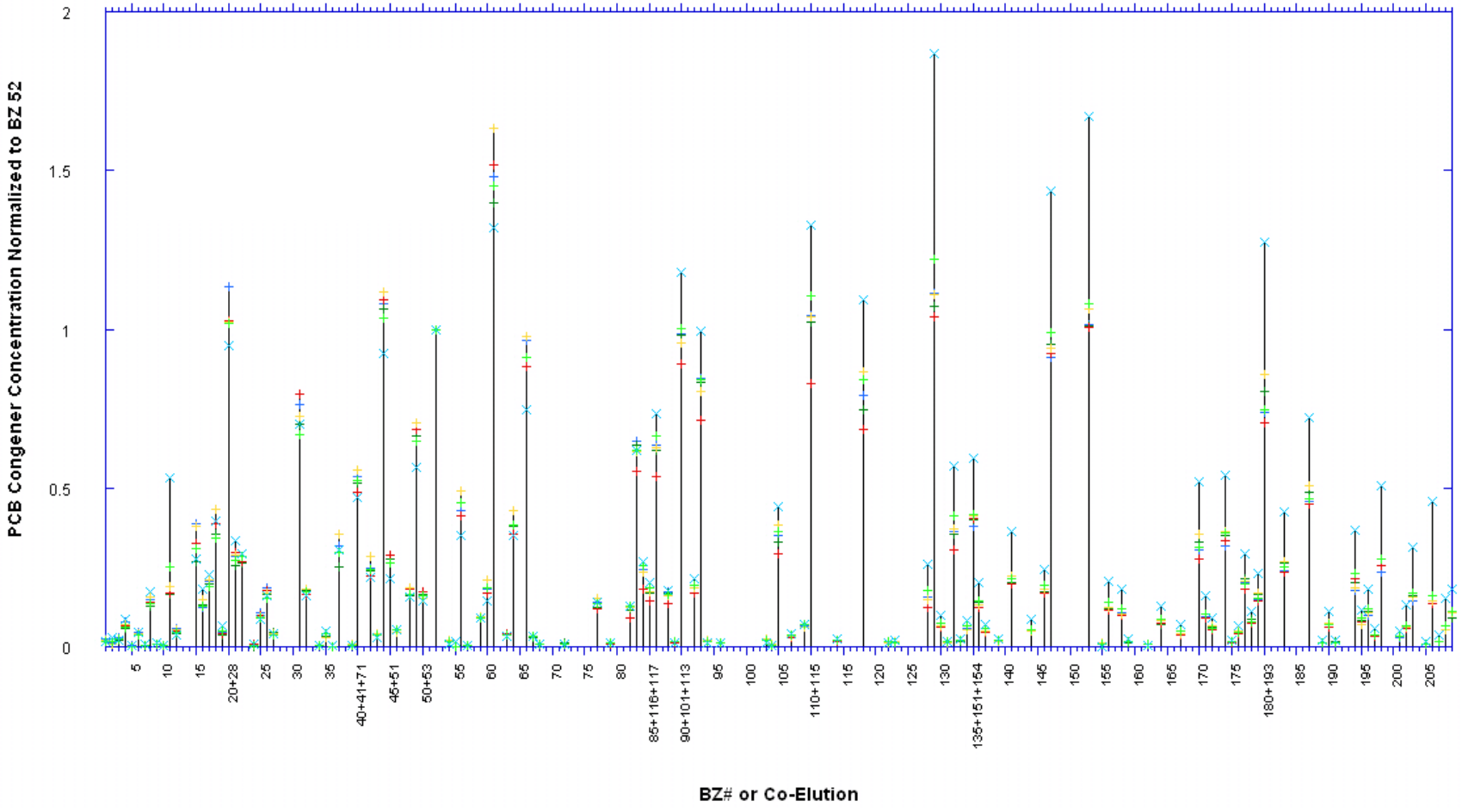
DDT Fingerprint in the Passaic River

Lower Passaic River Restoration Project

Figure 15-7

September 2008

MALCOLM PIRNIE



Legend

- RM 1.4
- RM 2.2
- RM 7.8
- RM 11
- RM 12.6
- Dundee Lake Core RM18.3

Notes

Normalized PCB Congener Concentration <0.01 are not plotted.

PCB Congener Concentration Normalized to Congener 52 Pattern for Dundee Dam and Lower Passaic River Surface Sediment

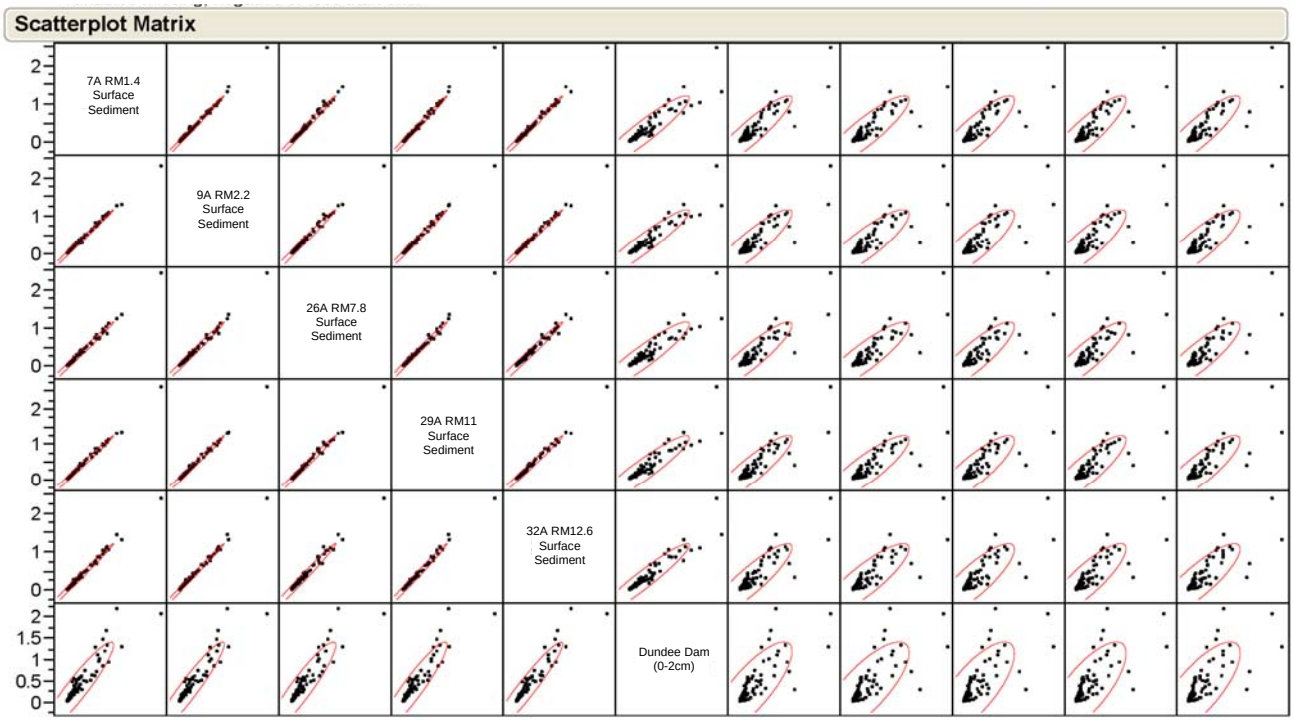
Lower Passaic River Restoration Project

Figure 15-8

September 2008

Multivariate Correlations

	7A RM1.4 Surface Sediment	9A RM2.2 Surface Sediment	26A RM7.8 Surface Sediment	29A RM11 Surface Sediment	32A RM12.6 Surface Sediment	Dundee Dam (0-2cm)	NB01SED031 (RM-3.0)	NB01SED030 (RM-3.4)	NB01SED024 (RM-4.0)	NB01SED021 (RM-4.1)	NB01SED017 (RM-4.6)
7A RM1.4 Surface Sediment	1.0000	0.9979	0.9964	0.9973	0.9967	0.9348	0.9167	0.8917	0.8755	0.8862	0.8802
9A RM2.2 Surface Sediment	0.9979	1.0000	0.9951	0.9968	0.9977	0.9467	0.8973	0.8710	0.8524	0.8629	0.8575
26A RM7.8 Surface Sediment	0.9964	0.9951	1.0000	0.9962	0.9922	0.9291	0.9119	0.8873	0.8718	0.8845	0.8774
29A RM11 Surface Sediment	0.9973	0.9968	0.9962	1.0000	0.9954	0.9346	0.9046	0.8787	0.8614	0.8731	0.8650
32A RM12.6 Surface Sediment	0.9967	0.9977	0.9922	0.9954	1.0000	0.9555	0.8931	0.8658	0.8467	0.8573	0.8525
Dundee Dam (0-2cm)	0.9348	0.9467	0.9291	0.9346	0.9555	1.0000	0.8000	0.7711	0.7475	0.7531	0.7582
NB01SED031 (RM-3.0)	0.9167	0.8973	0.9119	0.9046	0.8931	0.8000	1.0000	0.9965	0.9943	0.9952	0.9938
NB01SED030 (RM-3.4)	0.8917	0.8710	0.8873	0.8787	0.8658	0.7711	0.9965	1.0000	0.9972	0.9961	0.9965
NB01SED024 (RM-4.0)	0.8755	0.8524	0.8718	0.8614	0.8467	0.7475	0.9943	0.9972	1.0000	0.9978	0.9980
NB01SED021 (RM-4.1)	0.8862	0.8629	0.8845	0.8731	0.8573	0.7531	0.9952	0.9961	0.9978	1.0000	0.9976
NB01SED017 (RM-4.6)	0.8802	0.8575	0.8774	0.8650	0.8525	0.7582	0.9938	0.9965	0.9980	0.9976	1.0000



Legend

- PCB Congeners Concentration Normalized to Congener 52

Notes

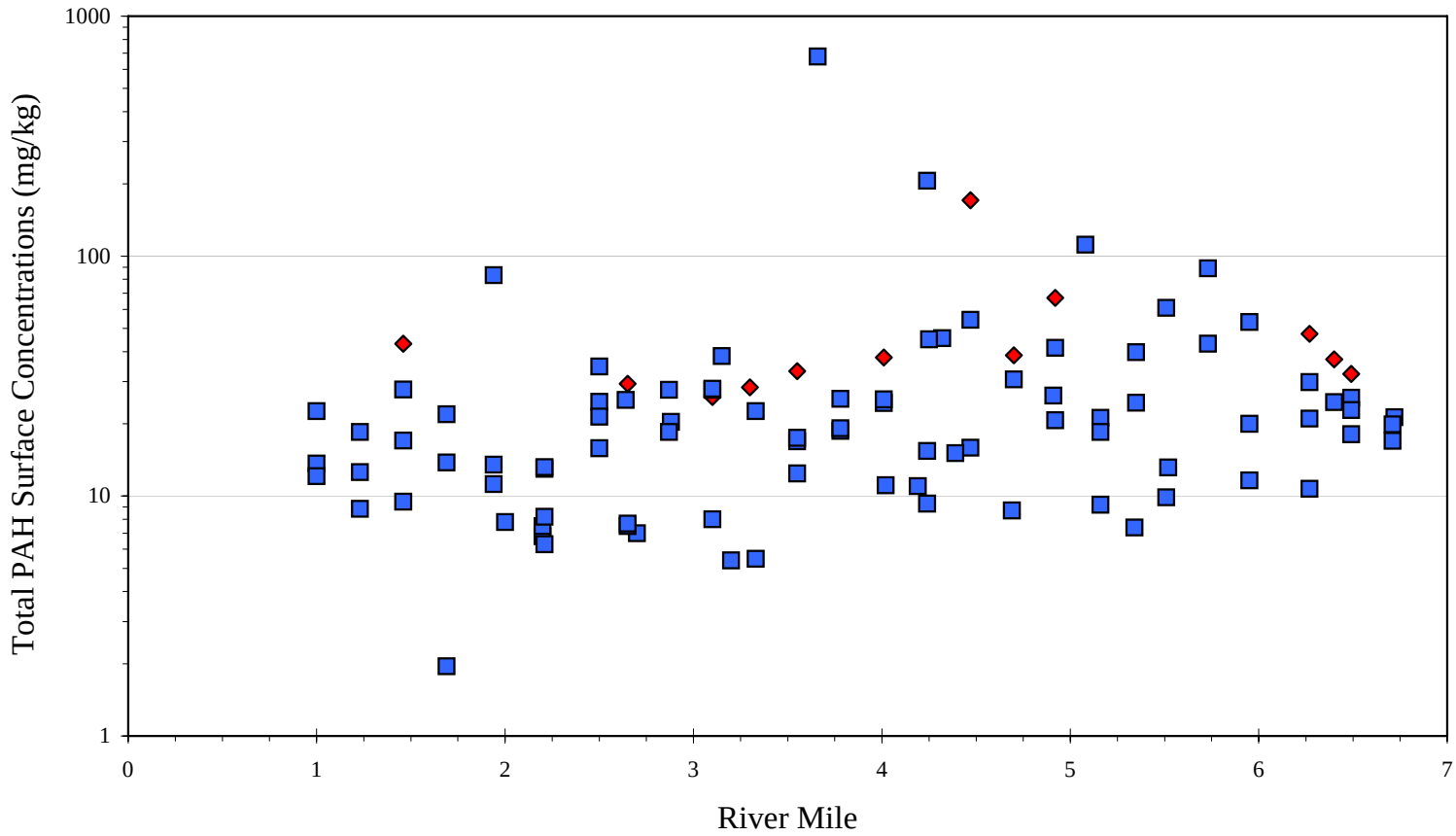
In this presentation, river miles for the Newark Bay sampling locations are assigned with respect to the distance from the mouth of the Lower Passaic River (RM0.0) and following the federal navigation channel.

Correlation Among Sampling Locations for PCB Congeners in Dundee Dam, Lower Passaic River, and Newark Bay Surface Sediment

Lower Passaic River Restoration Project

Figure 15-9

September 2008



Legend

Total PAH Surface Concentrations (1963)

Total PAH Surface Concentrations (1995)

Location

Notes

1995 Tierra Solutions Inc Dataset

"Surface Concentration 1995" = concentrations at 0 to 0.5 foot

"Concentrations at 1963" = interpolated concentration at depth of the corresponding cesium-137 peak

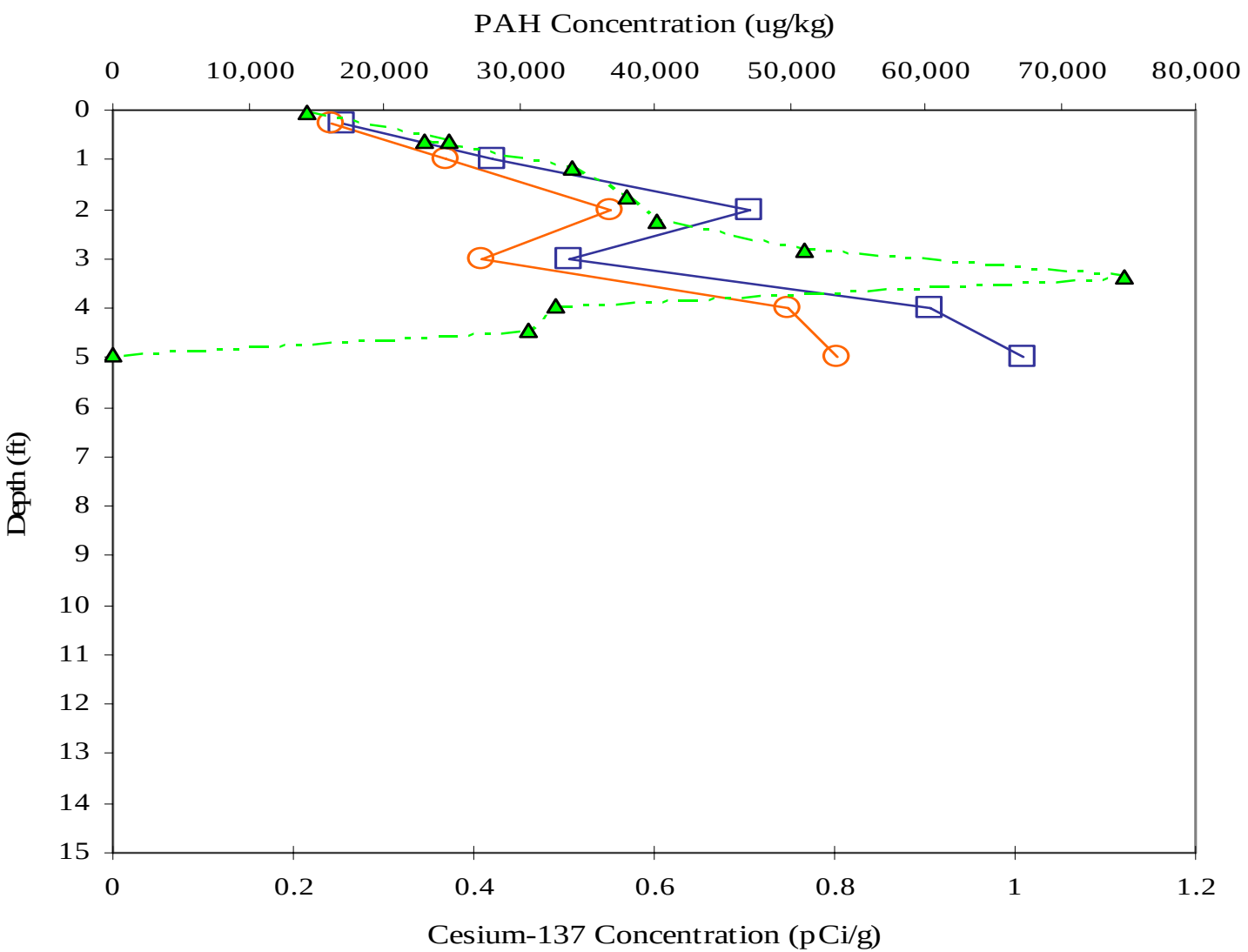
Non-detect (lab qualifier containing a U) plotted as half the reported detection limit

Comparison of Concentrations in 1963 and 1995, Total PAH

Lower Passaic River Restoration Project

Figure 15-10

September 2008



Legend

- Total PAH
- HMW PAH
- Cesium-137

Location

April 1995, River Mile 1.5
TSI Location 209

Notes

1. Total PAH represents the sum of the 16 Priority PAH Pollutants. If one or more of the PAHs were not analyzed, then Total PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero. Note that 2-methylnapthalene, benzo(e)pyrene, and perylene are not included in the summation because they are not a priority pollutant.

2. High Molecular Weight (HMW) PAH represents the sum of the 10 HMW PAH from the Priority PAH Pollutants list. If one or more of the PAHs were not analyzed, then HMW PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero.

3. Total PAH background concentrations were taken from ATSDR for urban soils. Available online:

http://www.atsdr.cdc.gov/toxprofiles/tp69-c5.pdf.

4. High background includes samples from Passaic Watershed.

US Army Corps of Engineers

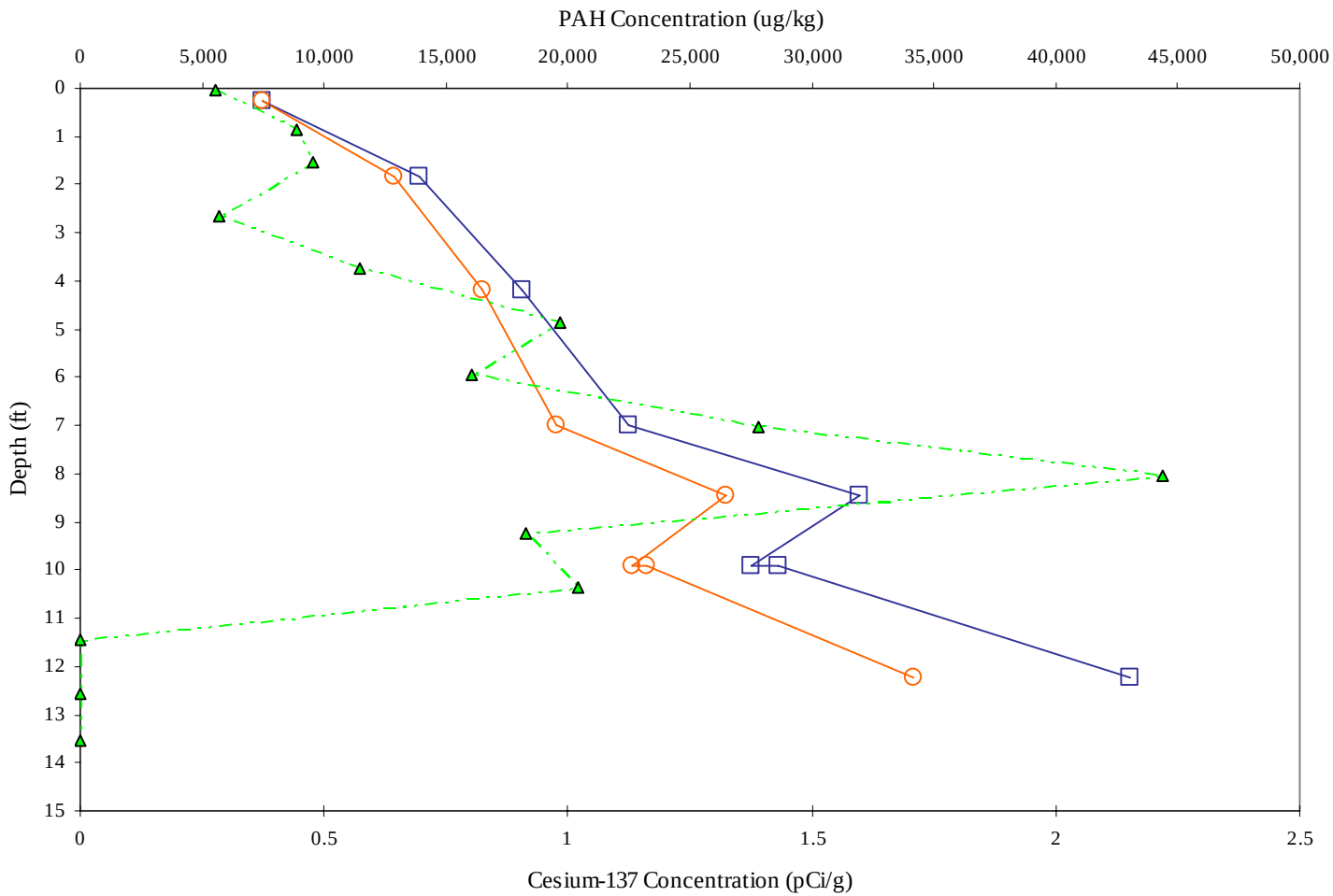
Downcore Profile for Total PAH and HMW PAH (River Mile 1.5)

Lower Passaic River Restoration Project

Figure 15-11a

September 2008

MALCOLM PIRNIE



Legend

- Total PAH
- HMW PAH
- Cesium-137

Location

April 1995, River Mile 2.7
TSI Location 222

Notes

1. Total PAH represents the sum of the 16 Priority PAH Pollutants. If one or more of the PAHs were not analyzed, then Total PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero. Note that 2-methylnapthalene, benzo(e)pyrene, and perylene are not included in the summation because they are not a priority pollutant.

2. High Molecular Weight (HMW) PAH represents the sum of the 10 HMW PAH from the Priority PAH Pollutants list. If one or more of the PAHs were not analyzed, then HMW PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero.

3. Total PAH background concentrations were taken from ATSDR for urban soils. Available online:

http://www.atsdr.cdc.gov/toxprofiles/tp69-c5.pdf.

4. High background includes samples from Passaic Watershed.

US Army Corps of Engineers

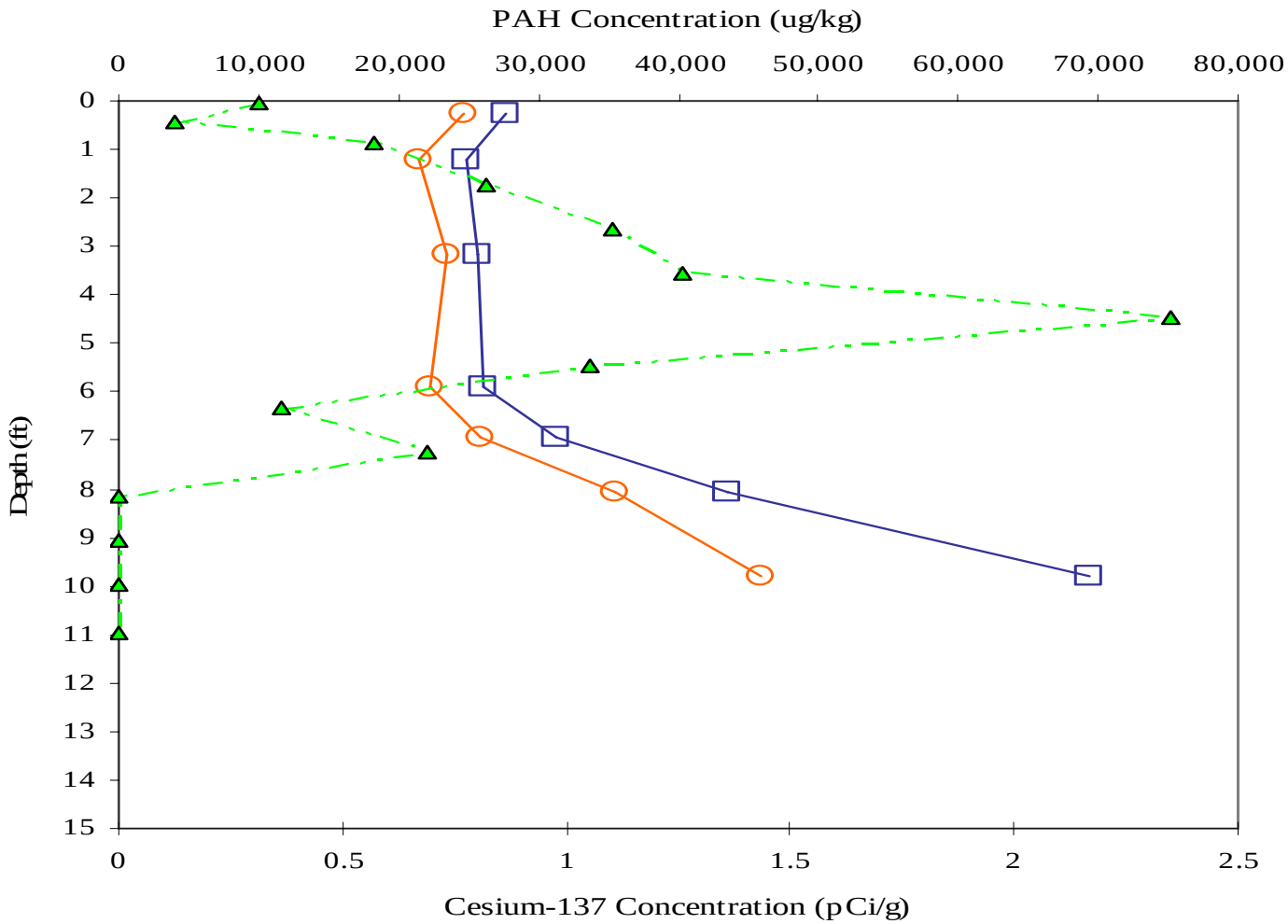
Downcore Profile for Total PAH and HMW PAH (River Mile 2.7)

Lower Passaic River Restoration Project

Figure 15-11b

September 2008

MALCOLM PIRNIE



Legend

- Total PAH
- HMW PAH
- Cesium-137

Location

May 1995, River Mile 3.1
TSI Location 228

Notes

1. Total PAH represents the sum of the 16 Priority PAH Pollutants. If one or more of the PAHs were not analyzed, then Total PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero. Note that 2-methylnapthalene, benzo(e)pyrene, and perylene are not included in the summation because they are not a priority pollutant.

2. High Molecular Weight (HMW) PAH represents the sum of the 10 HMW PAH from the Priority PAH Pollutants list. If one or more of the PAHs were not analyzed, then HMW PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero.

3. Total PAH background concentrations were taken from ATSDR for urban soils. Available online:

http://www.atsdr.cdc.gov/toxprofiles/tp69-c5.pdf.

4. High background includes samples from Passaic Watershed.

US Army Corps of Engineers

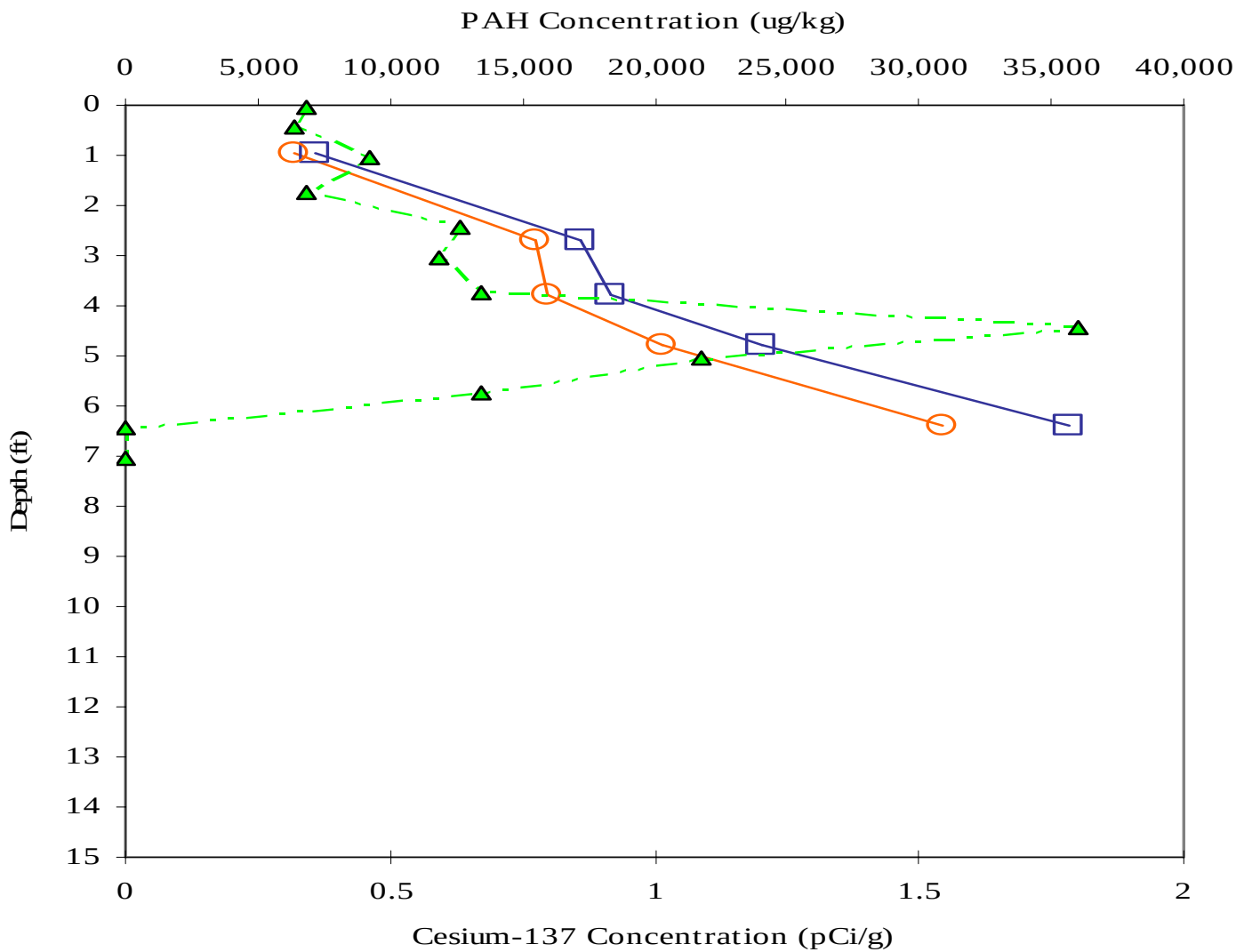
Downcore Profile for Total PAH and HMW PAH (River Mile 3.1)

Lower Passaic River Restoration Project

Figure 15-11c

September 2008

MALCOLM PIRNIE



Legend

- Total PAH
- HMW PAH
- Cesium-137

Location

May 1995, River Mile 3.1
TSI Location 230

Notes

1. Total PAH represents the sum of the 16 Priority PAH Pollutants. If one or more of the PAHs were not analyzed, then Total PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero. Note that 2-methylnapthalene, benzo(e)pyrene, and perylene are not included in the summation because they are not a priority pollutant.

2. High Molecular Weight (HMW) PAH represents the sum of the 10 HMW PAH from the Priority PAH Pollutants list. If one or more of the PAHs were not analyzed, then HMW PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero.

3. Total PAH background concentrations were taken from ATSDR for urban soils. Available online:

http://www.atsdr.cdc.gov/toxprofiles/tp69-c5.pdf.

4. High background includes samples from Passaic Watershed.

US Army Corps of Engineers

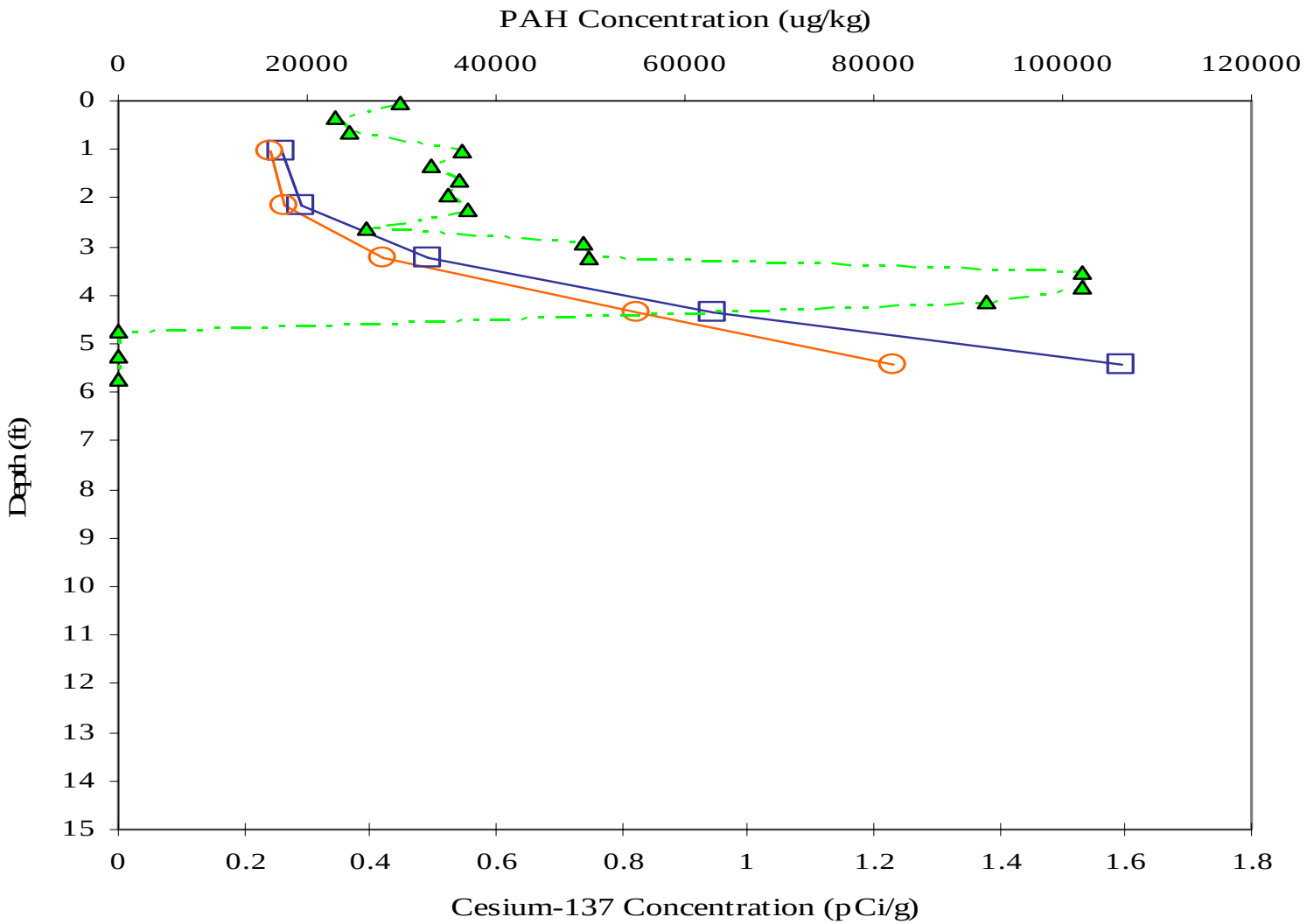
Downcore Profile for Total PAH and HMW PAH (River Mile 3.1)

Lower Passaic River Restoration Project

Figure 15-11d

September 2008

MALCOLM PIRNIE



Legend

- Total PAH
- HMW PAH
- Cesium-137

Location

May 1995, River Mile 3.3
TSI Location 232

Notes

1. Total PAH represents the sum of the 16 Priority PAH Pollutants. If one or more of the PAHs were not analyzed, then Total PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero. Note that 2-methylnapthalene, benzo(e)pyrene, and perylene are not included in the summation because they are not a priority pollutant.

2. High Molecular Weight (HMW) PAH represents the sum of the 10 HMW PAH from the Priority PAH Pollutants list. If one or more of the PAHs were not analyzed, then HMW PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero.

3. Total PAH background concentrations were taken from ATSDR for urban soils. Available online:

http://www.atsdr.cdc.gov/toxprofiles/tp69-c5.pdf.

4. High background includes samples from Passaic Watershed.

US Army Corps of Engineers

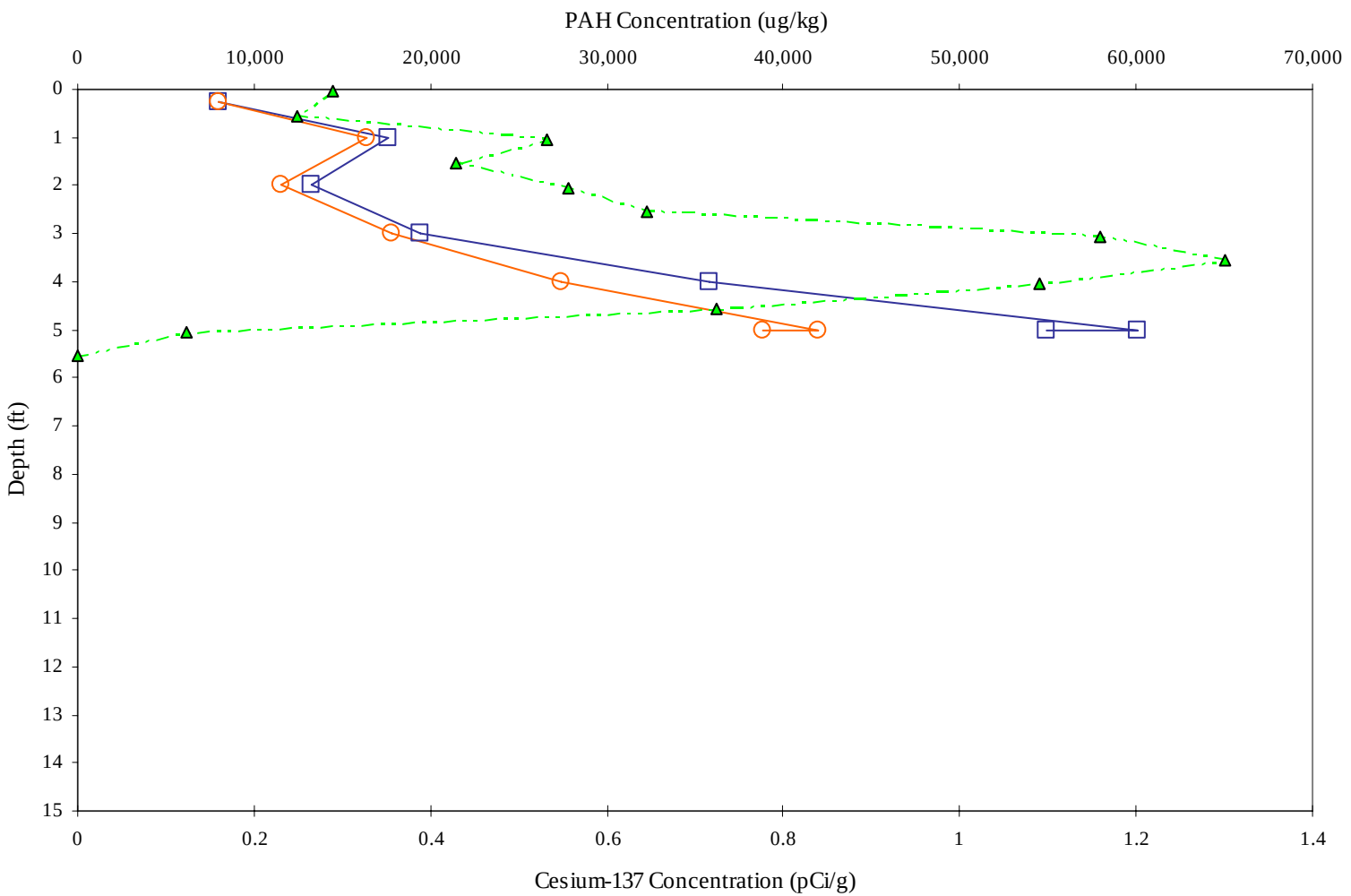
Downcore Profile for Total PAH and HMW PAH (River Mile 3.3)

Lower Passaic River Restoration Project

Figure 15-11e

September 2008

MALCOLM PIRNIE



Legend

- Total PAH
- HMW PAH
- Cesium-137

Location

June 1995, River Mile 3.3
TSI Location 286

Notes

1. Total PAH represents the sum of the 16 Priority PAH Pollutants. If one or more of the PAHs were not analyzed, then Total PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero. Note that 2-methylnapthalene, benzo(e)pyrene, and perylene are not included in the summation because they are not a priority pollutant.

2. High Molecular Weight (HMW) PAH represents the sum of the 10 HMW PAH from the Priority PAH Pollutants list. If one or more of the PAHs were not analyzed, then HMW PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero.

3. Total PAH background concentrations were taken from ATSDR for urban soils. Available online:

http://www.atsdr.cdc.gov/toxprofiles/tp69-c5.pdf.

4. High background includes samples from Passaic Watershed.

US Army Corps of Engineers

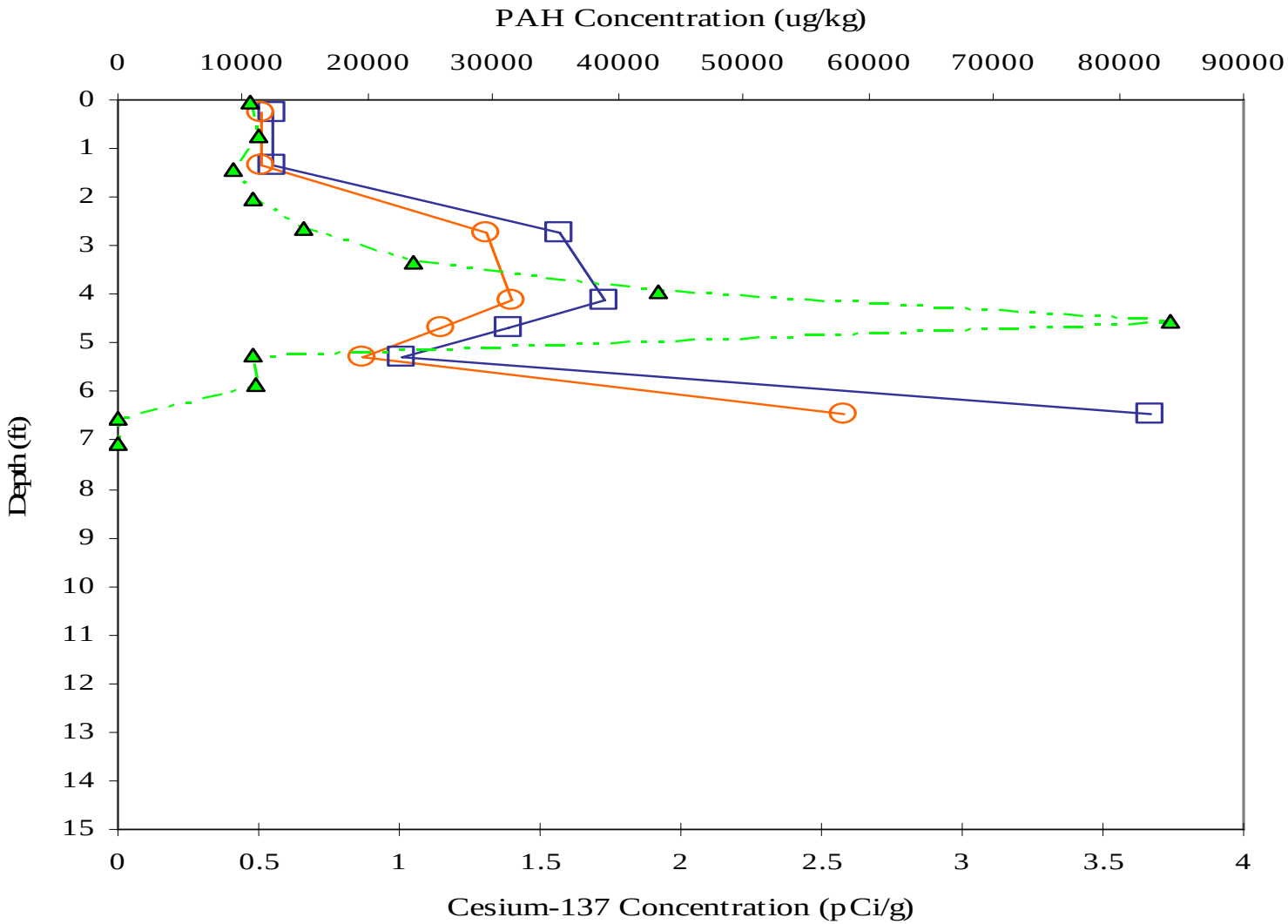
Downcore Profile for Total PAH and HMW PAH (River Mile 3.3)

Lower Passaic River Restoration Project

Figure 15-11f

September 2008

MALCOLM PIRNIE



Legend

- Total PAH
- HMW PAH
- Cesium-137

Location

May 1995, River Mile 3.6
TSI Location 235

Notes

1. Total PAH represents the sum of the 16 Priority PAH Pollutants. If one or more of the PAHs were not analyzed, then Total PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero. Note that 2-methylnapthalene, benzo(e)pyrene, and perylene are not included in the summation because they are not a priority pollutant.

2. High Molecular Weight (HMW) PAH represents the sum of the 10 HMW PAH from the Priority PAH Pollutants list. If one or more of the PAHs were not analyzed, then HMW PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero.

3. Total PAH background concentrations were taken from ATSDR for urban soils. Available online:

http://www.atsdr.cdc.gov/toxprofiles/tp69-c5.pdf.

4. High background includes samples from Passaic Watershed.

US Army Corps of Engineers

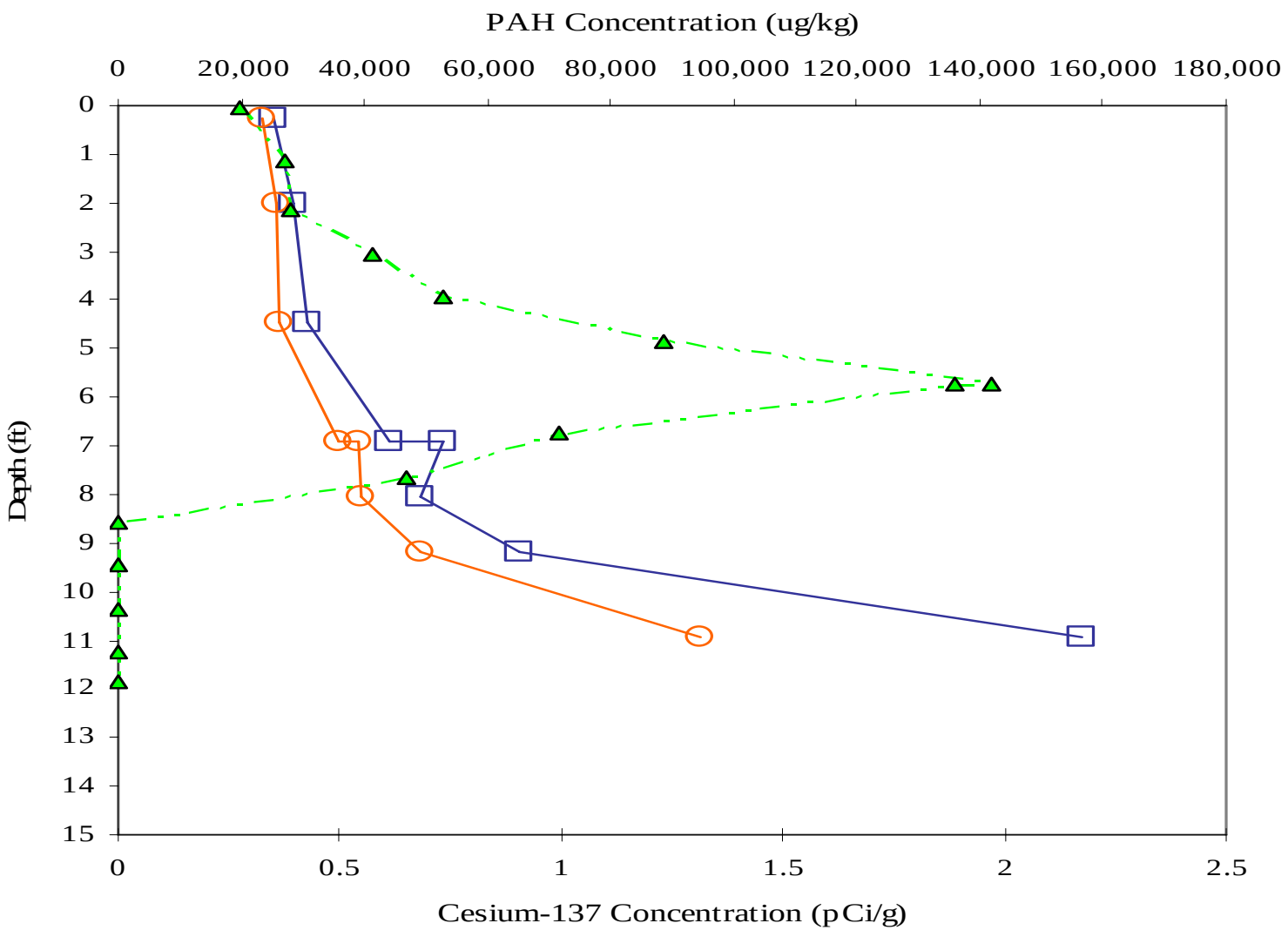
Downcore Profile for Total PAH and HMW PAH (River Mile 3.6)

Lower Passaic River Restoration Project

Figure 15-11g

September 2008

MALCOLM PIRNIE



Legend

- Total PAH
- HMW PAH
- Cesium-137

Location

May 1995, River Mile 4.0
TSI Location 241

Notes

1. Total PAH represents the sum of the 16 Priority PAH Pollutants. If one or more of the PAHs were not analyzed, then Total PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero. Note that 2-methylnapthalene, benzo(e)pyrene, and perylene are not included in the summation because they are not a priority pollutant.

2. High Molecular Weight (HMW) PAH represents the sum of the 10 HMW PAH from the Priority PAH Pollutants list. If one or more of the PAHs were not analyzed, then HMW PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero.

3. Total PAH background concentrations were taken from ATSDR for urban soils. Available online:

http://www.atsdr.cdc.gov/toxprofiles/tp69-c5.pdf.

4. High background includes samples from Passaic Watershed.

US Army Corps of Engineers

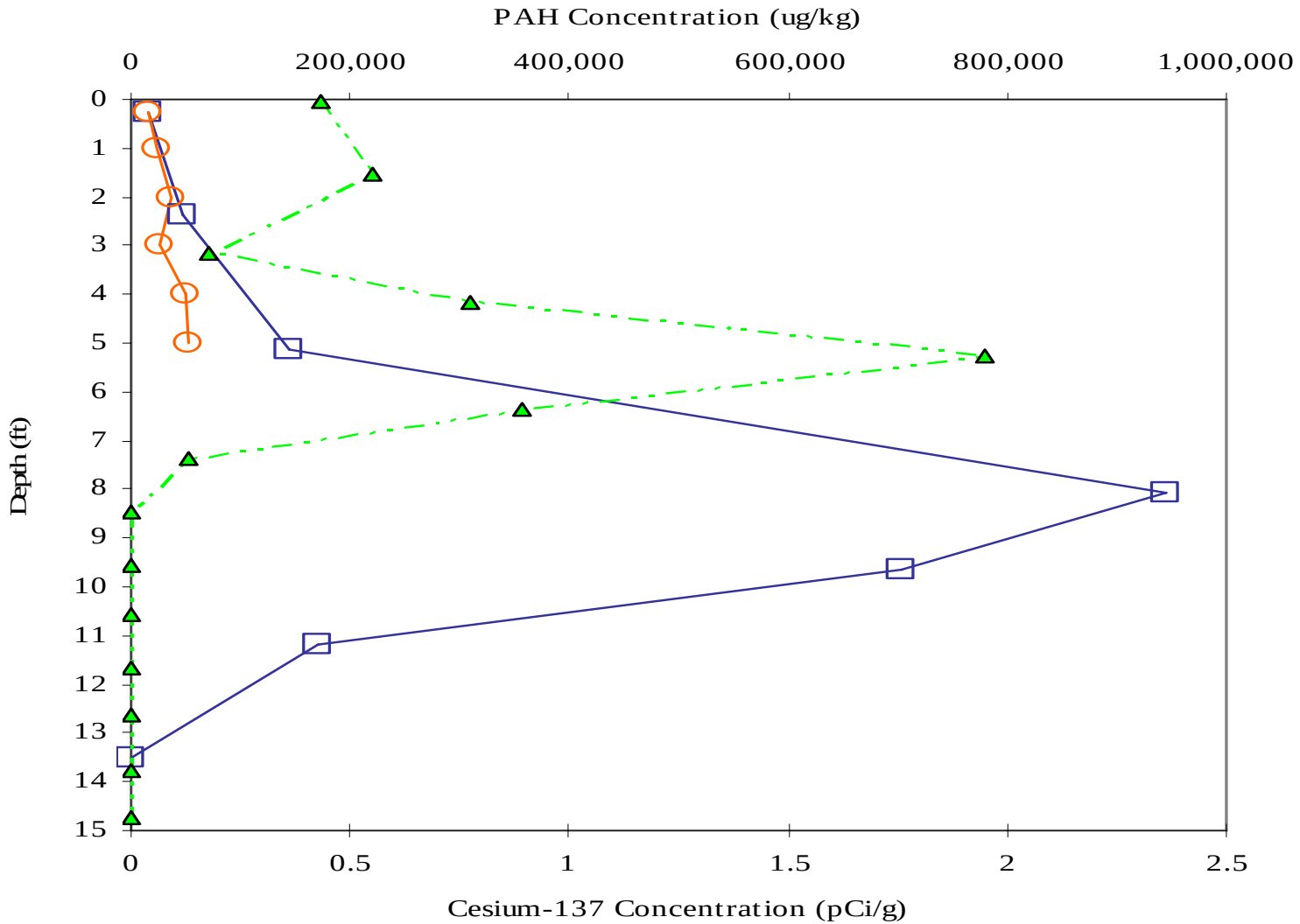
Downcore Profile for Total PAH and HMW PAH (River Mile 4.0)

Lower Passaic River Restoration Project

Figure 15-11h

September 2008

MALCOLM PIRNIE



Legend

- Total PAH
- HMW PAH
- Cesium-137

Location

May 1995, River Mile 4.5
TSI Location 248

Notes

1. Total PAH represents the sum of the 16 Priority PAH Pollutants. If one or more of the PAHs were not analyzed, then Total PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero. Note that 2-methylnapthalene, benzo(e)pyrene, and perylene are not included in the summation because they are not a priority pollutant.

2. High Molecular Weight (HMW) PAH represents the sum of the 10 HMW PAH from the Priority PAH Pollutants list. If one or more of the PAHs were not analyzed, then HMW PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero.

3. Total PAH background concentrations were taken from ATSDR for urban soils. Available online:

http://www.atsdr.cdc.gov/toxprofiles/tp69-c5.pdf.

4. High background includes samples from Passaic Watershed.

US Army Corps of Engineers

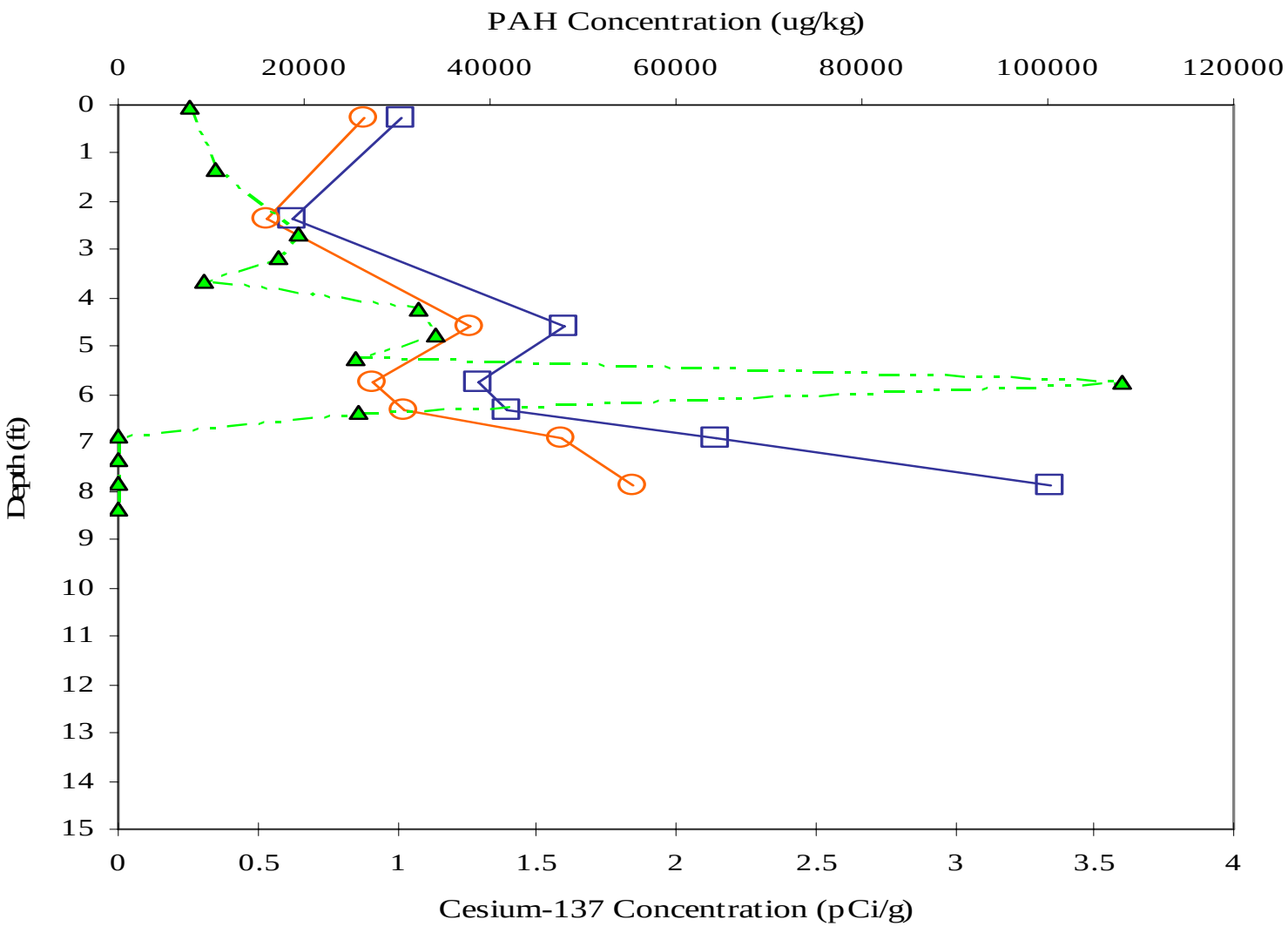
Downcore Profile for Total PAH and HMW PAH
River Mile 4.5)

Lower Passaic River Restoration Project

Figure 15-11i

September 2008

MALCOLM PIRNIE



Legend

- Total PAH
- HMW PAH
- Cesium-137

Location

May 1995, River Mile 4.7
TSI Location 251

Notes

1. Total PAH represents the sum of the 16 Priority PAH Pollutants. If one or more of the PAHs were not analyzed, then Total PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero. Note that 2-methylnapthalene, benzo(e)pyrene, and perylene are not included in the summation because they are not a priority pollutant.

2. High Molecular Weight (HMW) PAH represents the sum of the 10 HMW PAH from the Priority PAH Pollutants list. If one or more of the PAHs were not analyzed, then HMW PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero.

3. Total PAH background concentrations were taken from ATSDR for urban soils. Available online:

http://www.atsdr.cdc.gov/toxprofiles/tp69-c5.pdf.

4. High background includes samples from Passaic Watershed.

US Army Corps of Engineers

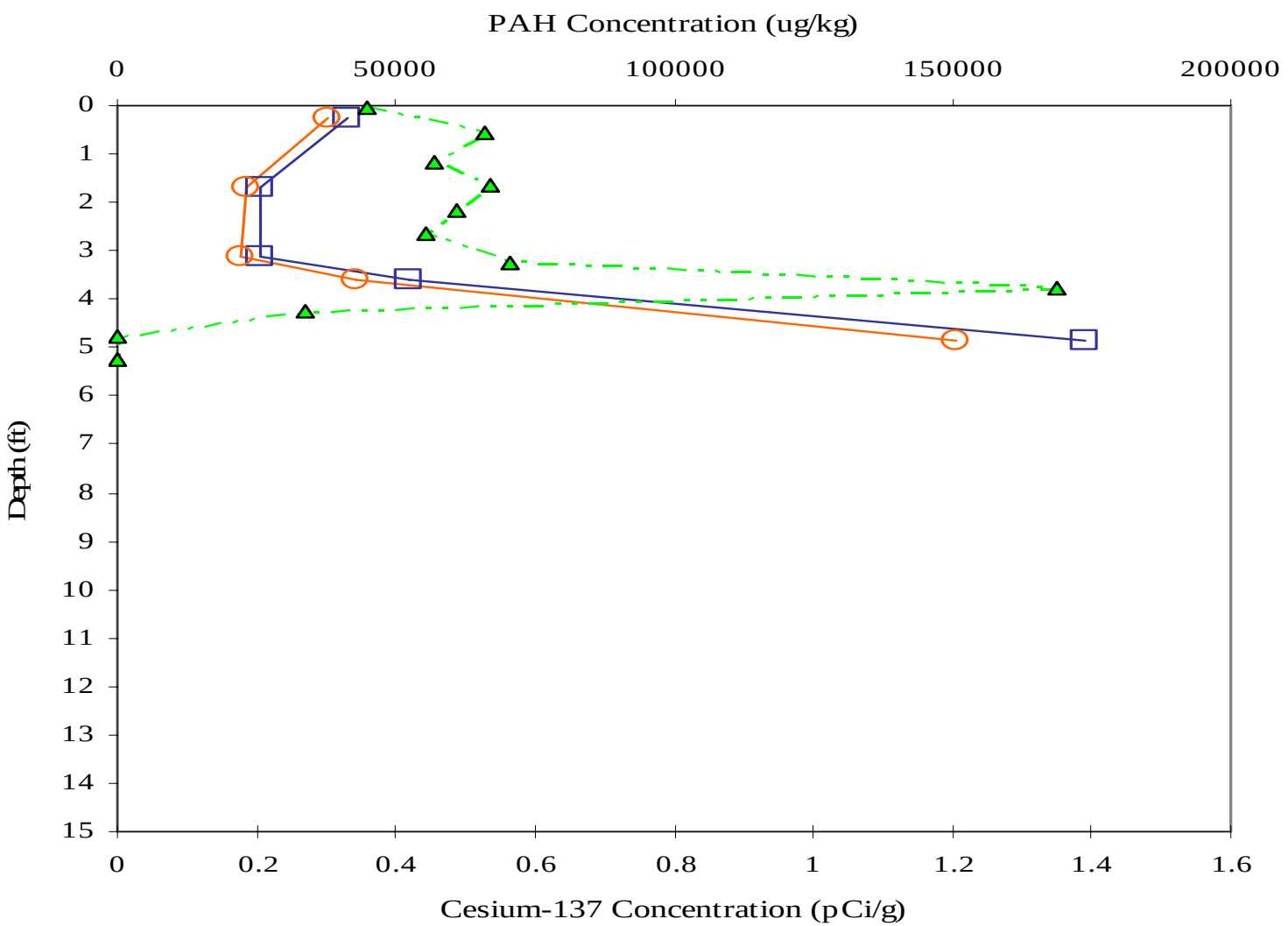
Downcore Profile for Total PAH and HMW PAH (River Mile 4.7)

Lower Passaic River Restoration Project

Figure 15-11j

September 2008

MALCOLM PIRNIE



Legend

- Total PAH
- HMW PAH
- Cesium-137

Location

May 1995, River Mile 4.9
TSI Location 253

Notes

1. Total PAH represents the sum of the 16 Priority PAH Pollutants. If one or more of the PAHs were not analyzed, then Total PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero. Note that 2-methylnapthalene, benzo(e)pyrene, and perylene are not included in the summation because they are not a priority pollutant.

2. High Molecular Weight (HMW) PAH represents the sum of the 10 HMW PAH from the Priority PAH Pollutants list. If one or more of the PAHs were not analyzed, then HMW PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero.

3. Total PAH background concentrations were taken from ATSDR for urban soils. Available online:

http://www.atsdr.cdc.gov/toxprofiles/tp69-c5.pdf.

4. High background includes samples from Passaic Watershed.

US Army Corps of Engineers

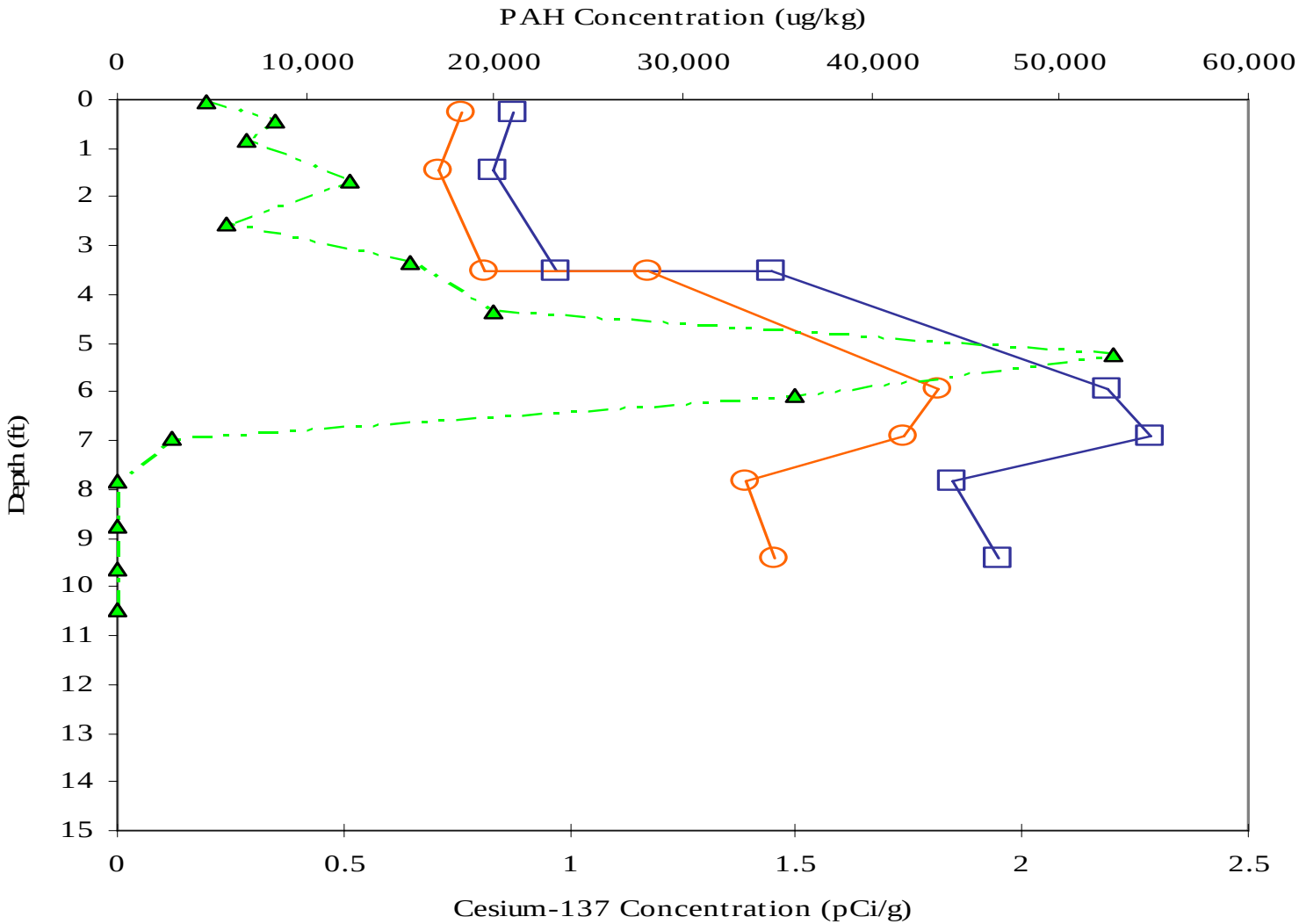
Downcore Profile for Total PAH and HMW PAH (River Mile 4.9)

Lower Passaic River Restoration Project

Figure 15-11k

September 2008

MALCOLM PIRNIE



Legend

- Total PAH
- HMW PAH
- Cesium-137

Location

May 1995, River Mile 6.3
TSI Location 272

Notes

1. Total PAH represents the sum of the 16 Priority PAH Pollutants. If one or more of the PAHs were not analyzed, then Total PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero. Note that 2-methylnapthalene, benzo(e)pyrene, and perylene are not included in the summation because they are not a priority pollutant.

2. High Molecular Weight (HMW) PAH represents the sum of the 10 HMW PAH from the Priority PAH Pollutants list. If one or more of the PAHs were not analyzed, then HMW PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero.

3. Total PAH background concentrations were taken from ATSDR for urban soils. Available online:

http://www.atsdr.cdc.gov/toxprofiles/tp69-c5.pdf.

4. High background includes samples from Passaic Watershed.

US Army Corps of Engineers

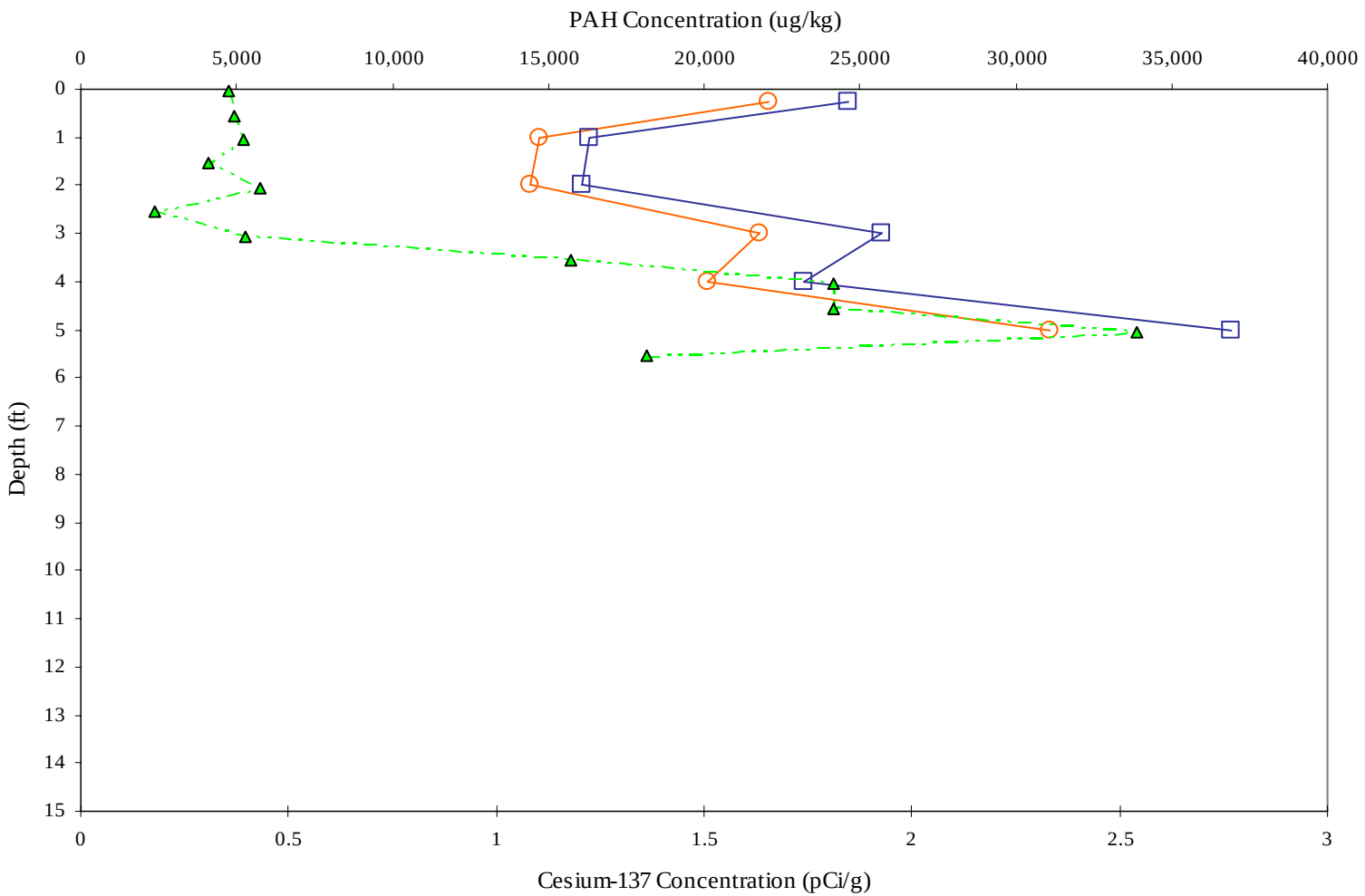
Downcore Profile for Total PAH and HMW PAH (River Mile 6.3)

Lower Passaic River Restoration Project

Figure 15-11l

September 2008

MALCOLM PIRNIE



Legend

- Total PAH
- HMW PAH
- Cesium-137

Location

June 1995, River Mile 6.4
TSI Location 296

Notes

1. Total PAH represents the sum of the 16 Priority PAH Pollutants. If one or more of the PAHs were not analyzed, then Total PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero. Note that 2-methylnapthalene, benzo(e)pyrene, and perylene are not included in the summation because they are not a priority pollutant.

2. High Molecular Weight (HMW) PAH represents the sum of the 10 HMW PAH from the Priority PAH Pollutants list. If one or more of the PAHs were not analyzed, then HMW PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero.

3. Total PAH background concentrations were taken from ATSDR for urban soils. Available online:

http://www.atsdr.cdc.gov/toxprofiles/tp69-c5.pdf.

4. High background includes samples from Passaic Watershed.

US Army Corps of Engineers

Downcore Profile for Total PAH and HMW PAH (River Mile 6.4)

Lower Passaic River Restoration Project

Figure 15-11m

September 2008

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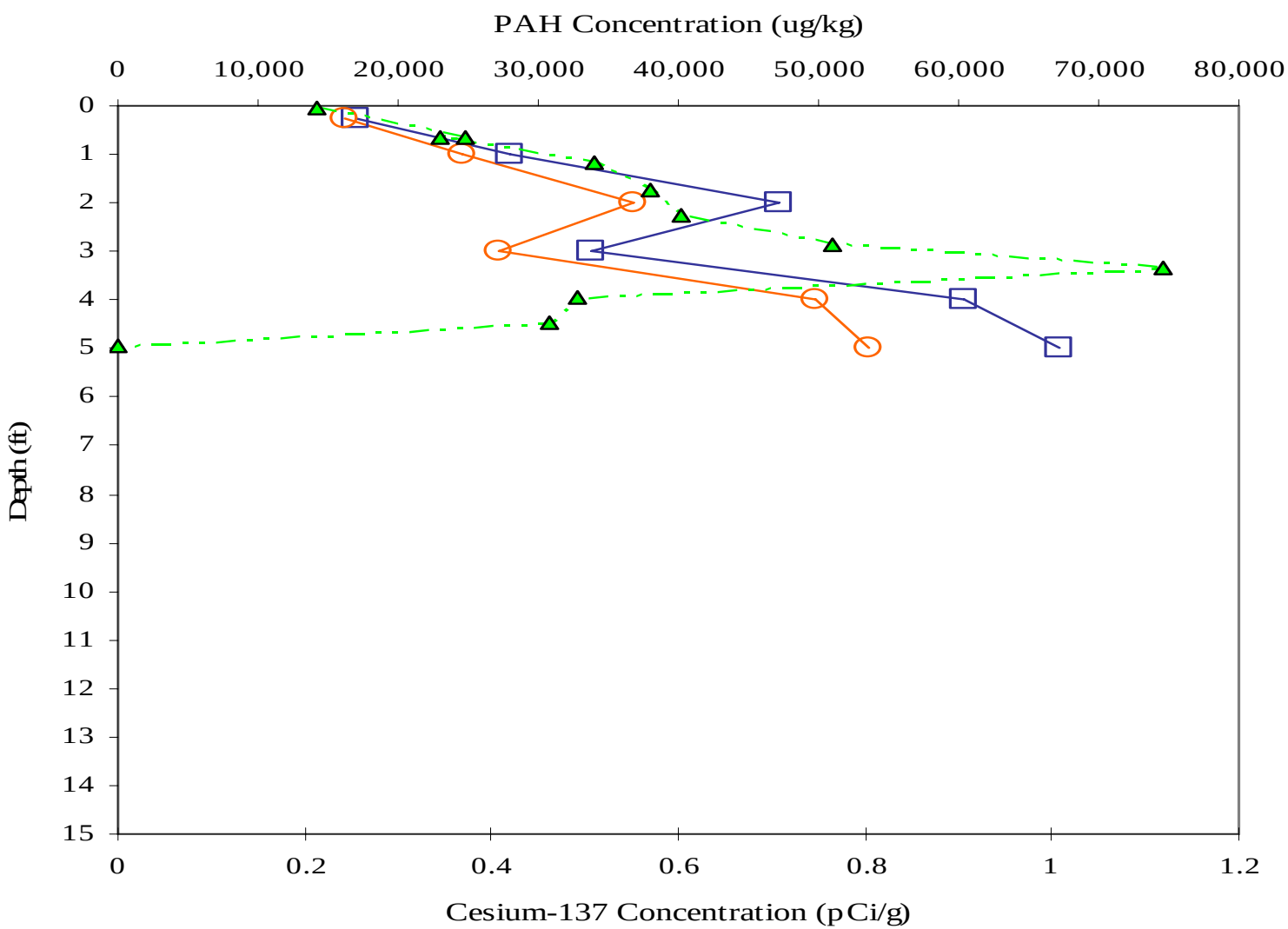


Legend

- Total PAH
- HMW PAH
- Cesium-137

Location

June 1995, River Mile 6.5
TSI Location 275

Notes

1. Total PAH represents the sum of the 16 Priority PAH Pollutants. If one or more of the PAHs were not analyzed, then Total PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero. Note that 2-methylnapthalene, benzo(e)pyrene, and perylene are not included in the summation because they are not a priority pollutant.

2. High Molecular Weight (HMW) PAH represents the sum of the 10 HMW PAH from the Priority PAH Pollutants list. If one or more of the PAHs were not analyzed, then HMW PAH is not plotted. Non-detected values (lab qualifier containing a U) are included in the summation as zero.

3. Total PAH background concentrations were taken from ATSDR for urban soils. Available online:

http://www.atsdr.cdc.gov/toxprofiles/tp69-c5.pdf.

4. High background includes samples from Passaic Watershed.

US Army Corps of Engineers

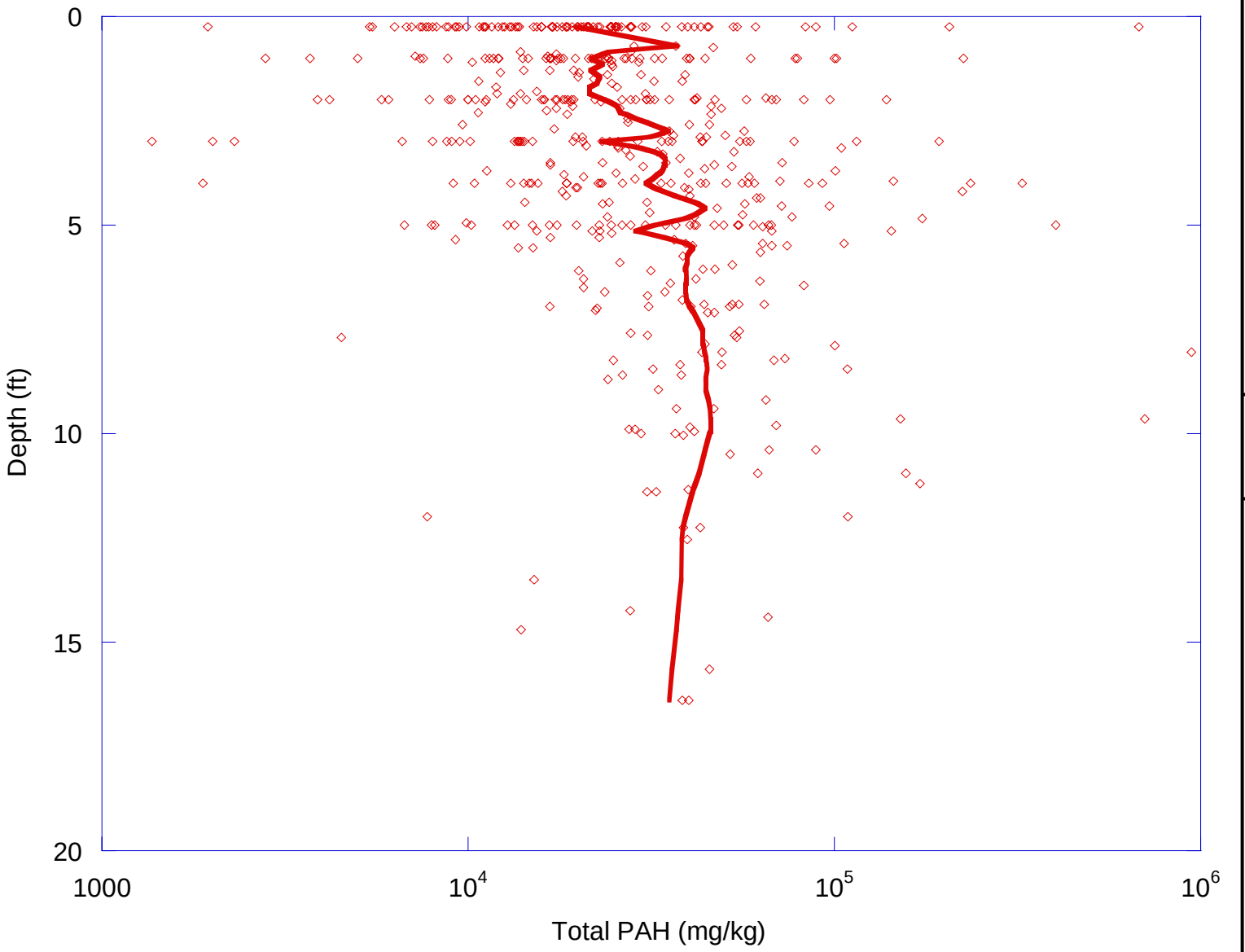
Downcore Profile for Total PAH and HMW PAH (River Mile 6.5)

Lower Passaic River Restoration Project

Figure 15-11n

September 2008

MALCOLM PIRNIE



Legend

Location

River Mile 1 to River Mile 7

Notes

US Army Corps of Engineers

Total PAH Concentration vs. Mid-Depth of Sediment Core

Lower Passaic River Restoration Project

Figure 15-12

September 2008

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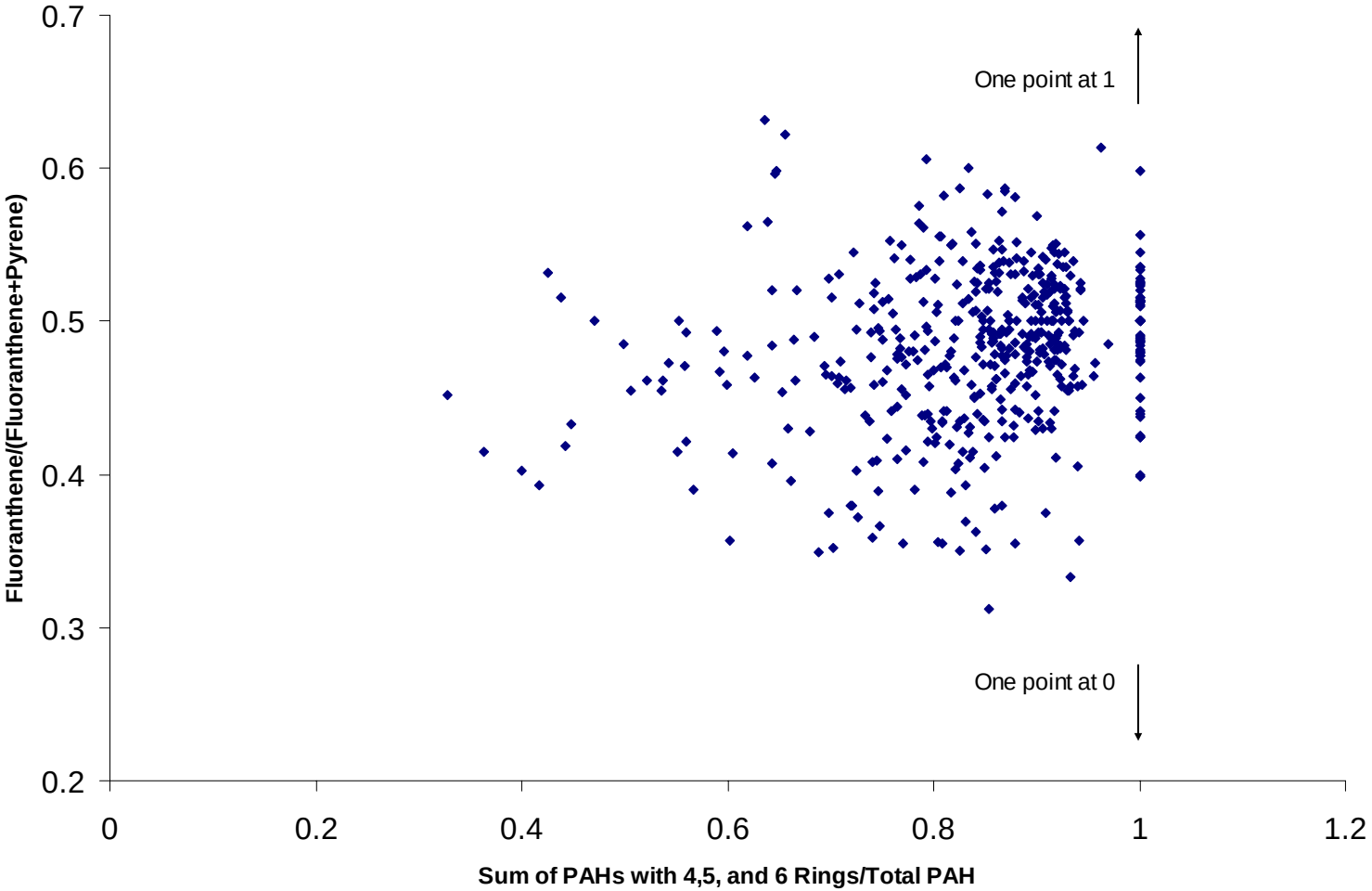


Legend

Location

River Mile 1 to River Mile 7

Notes

Data Source:
Tierra Solutions, Inc.,
1995 Dataset

US Army Corps of Engineers

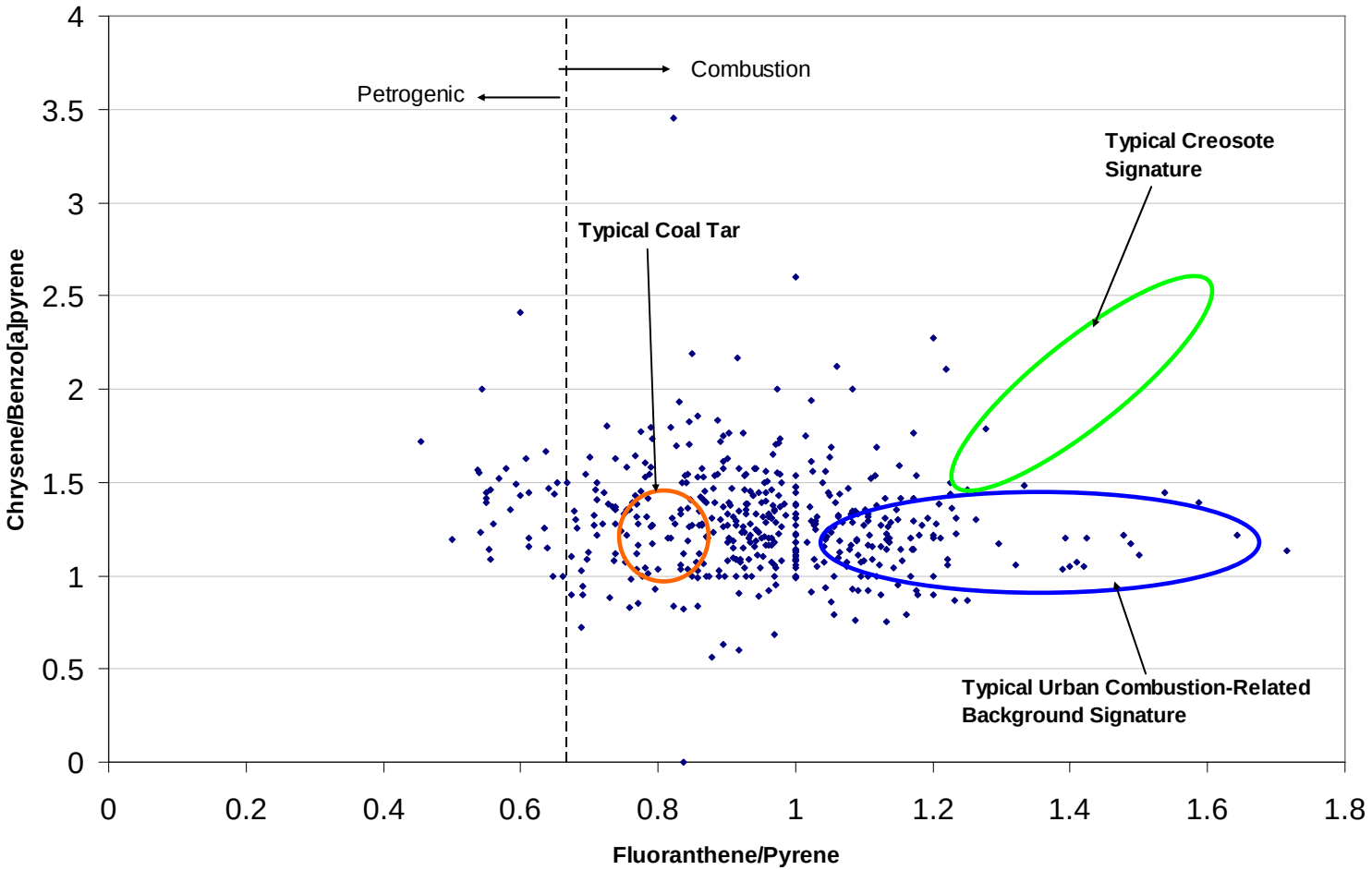
PAH Indicator Ratios for Passaic River Sediments

Lower Passaic River Restoration Project

Figure 15-13

September 2008

MALCOLM PIRNIE



Legend

Location

Notes

US Army Corps of Engineers

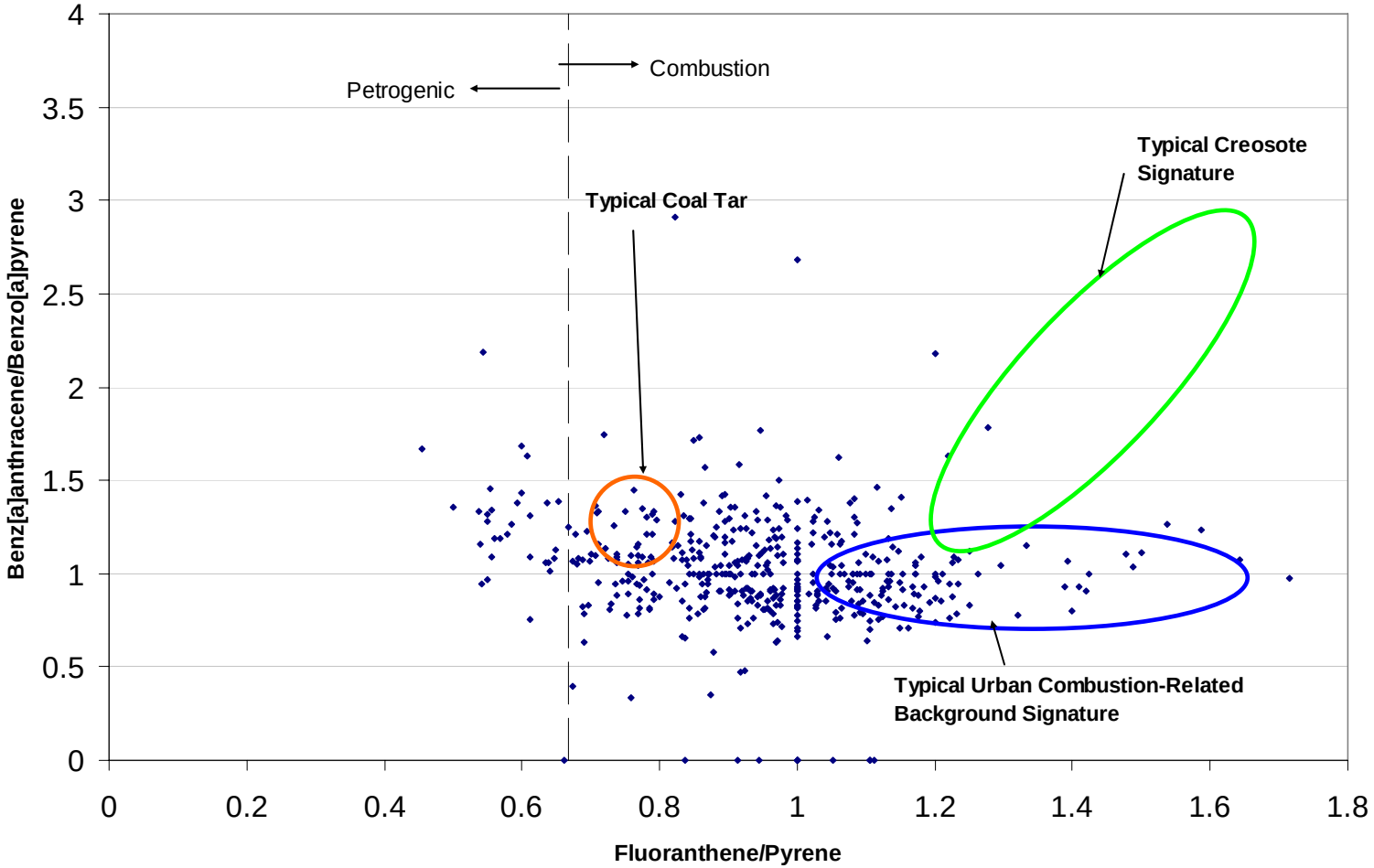
Double Ratio Analysis: Passaic River Sediment PAH Compared to Costa and Sauer (2005) Source Signatures

Lower Passaic River Restoration Project

Figure 15-14a

September 2008

MALCOLM PIRNIE



Legend

Location

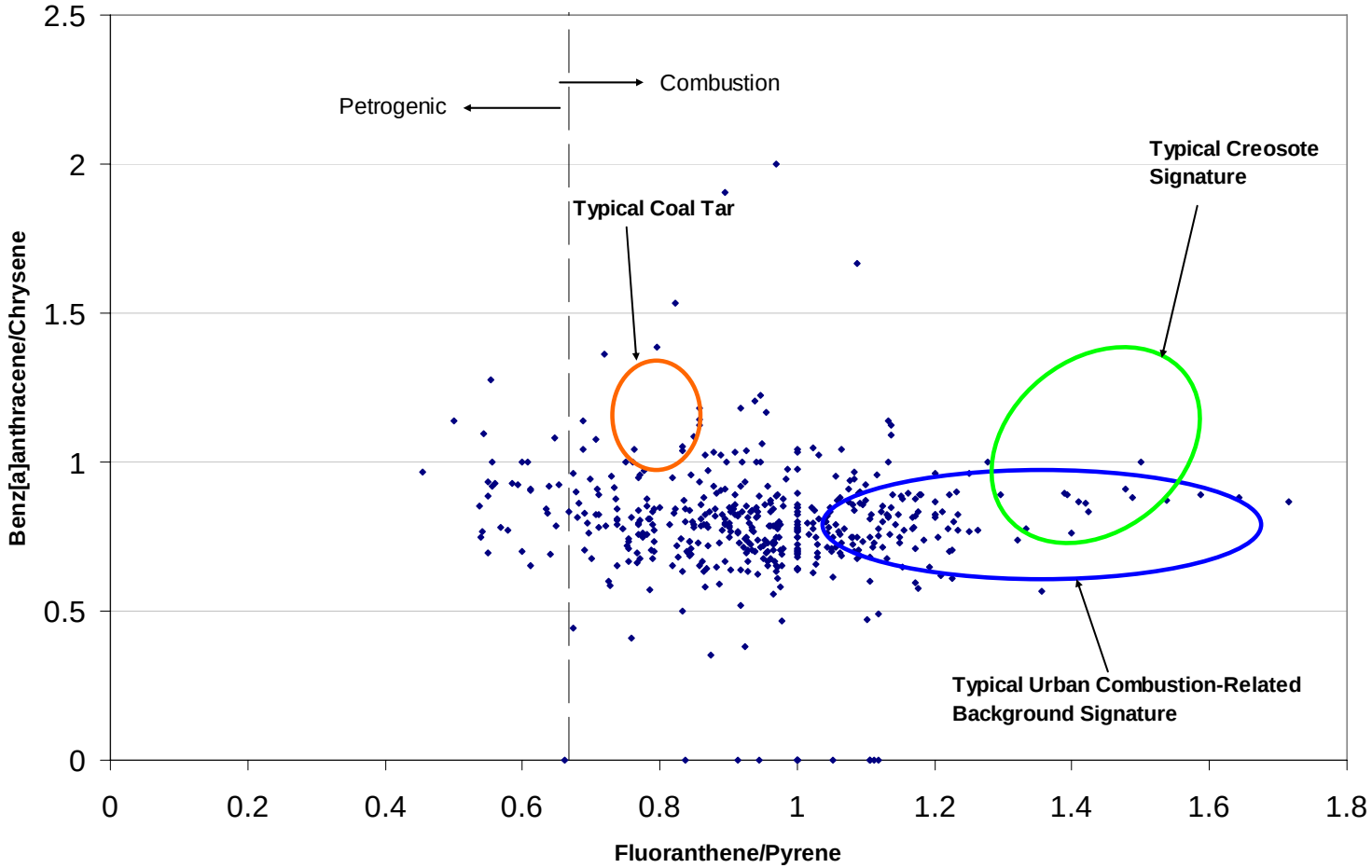
Notes

Double Ratio Analysis: Passaic River Sediment PAH Compared to Costa and Sauer (2005) Source Signatures

Lower Passaic River Restoration Project

Figure 15-14b

September 2008



Legend

Location

Notes

US Army Corps of Engineers

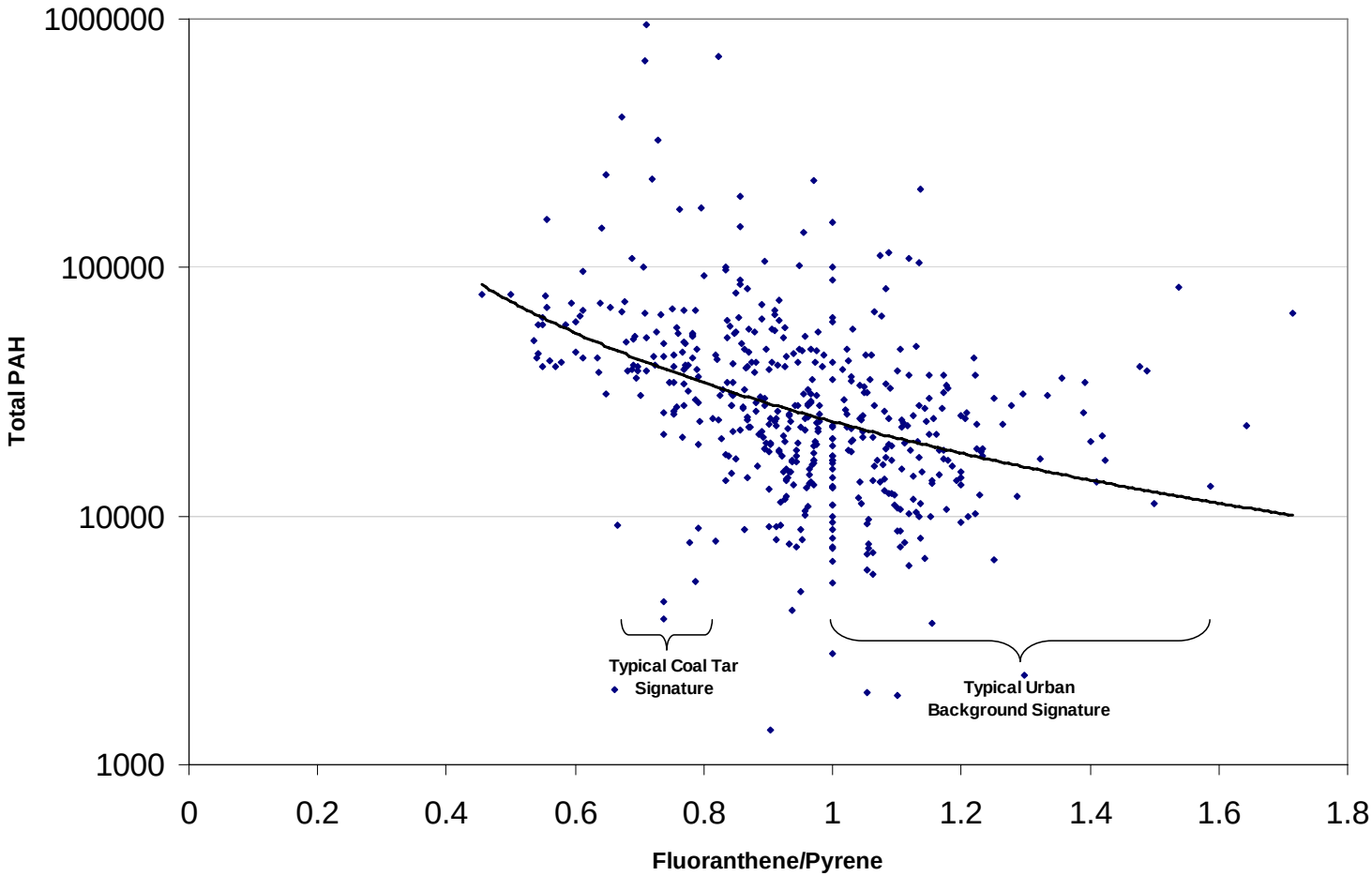
Double Ratio Analysis: Passaic River Sediment PAH Compared to Costa and Sauer (2005) Source Signatures

Lower Passaic River Restoration Project

Figure 15-14c

September 2008

MALCOLM PIRNIE



Legend

Location

Notes

US Army Corps of Engineers

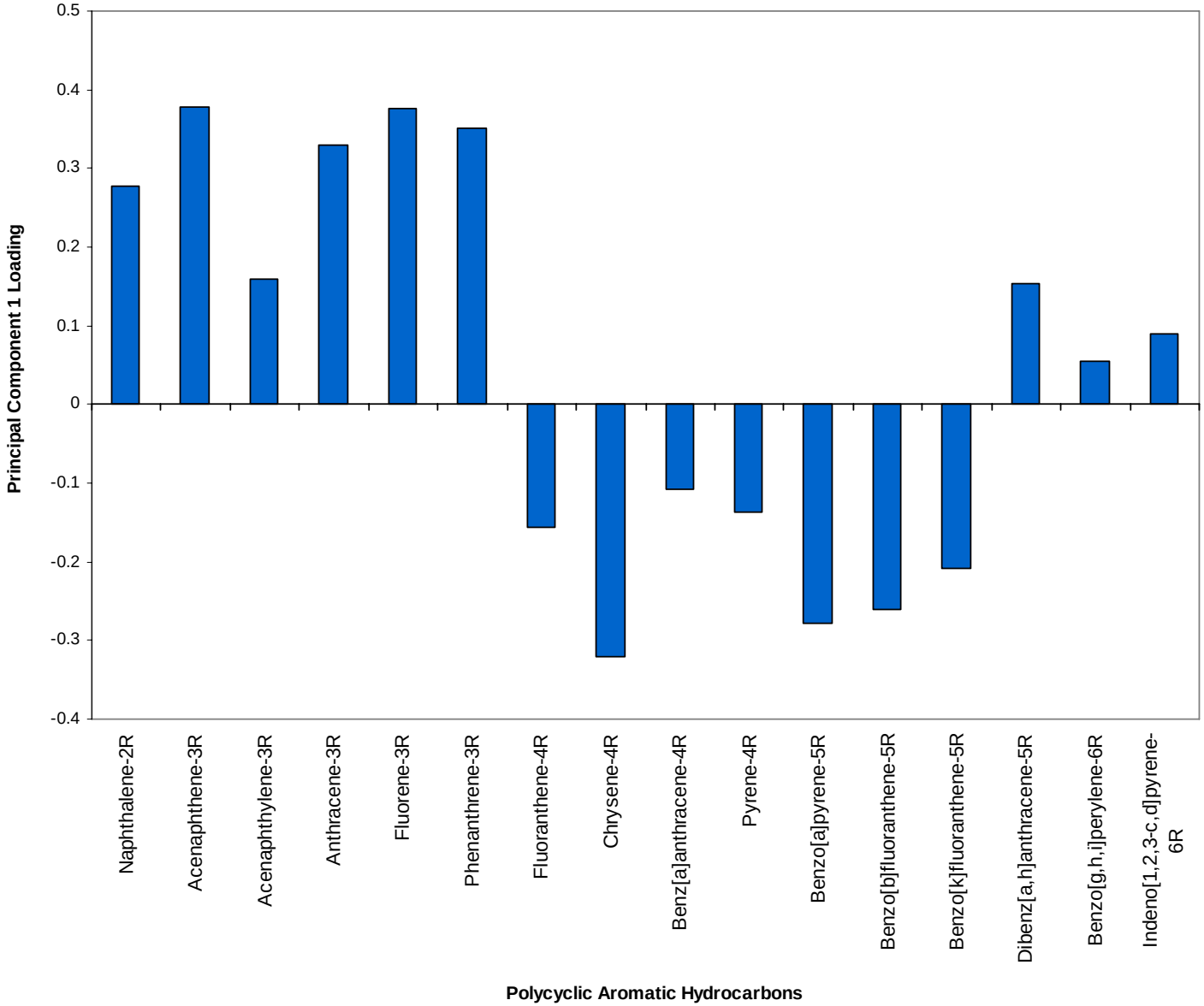
Total PAH vs. Fluoranthene/Pyrene Ratio

Lower Passaic River Restoration Project

Figure 15-15

September 2008

MALCOLM PIRNIE



Legend

Location

River Mile 1 to River Mile 7

Notes

Data Source:
Tierra Solutions, Inc. 1995 Dataset

Each individual PAH is followed by an indicator of the number of rings in that constituent. For example:

Anthracene-3R => the "3R" indicates Anthracene is a 3-ring PAH.

Chrysene-4R => the "4R" indicates that Chrysene is a 4-ring PAH.

US Army Corps of Engineers

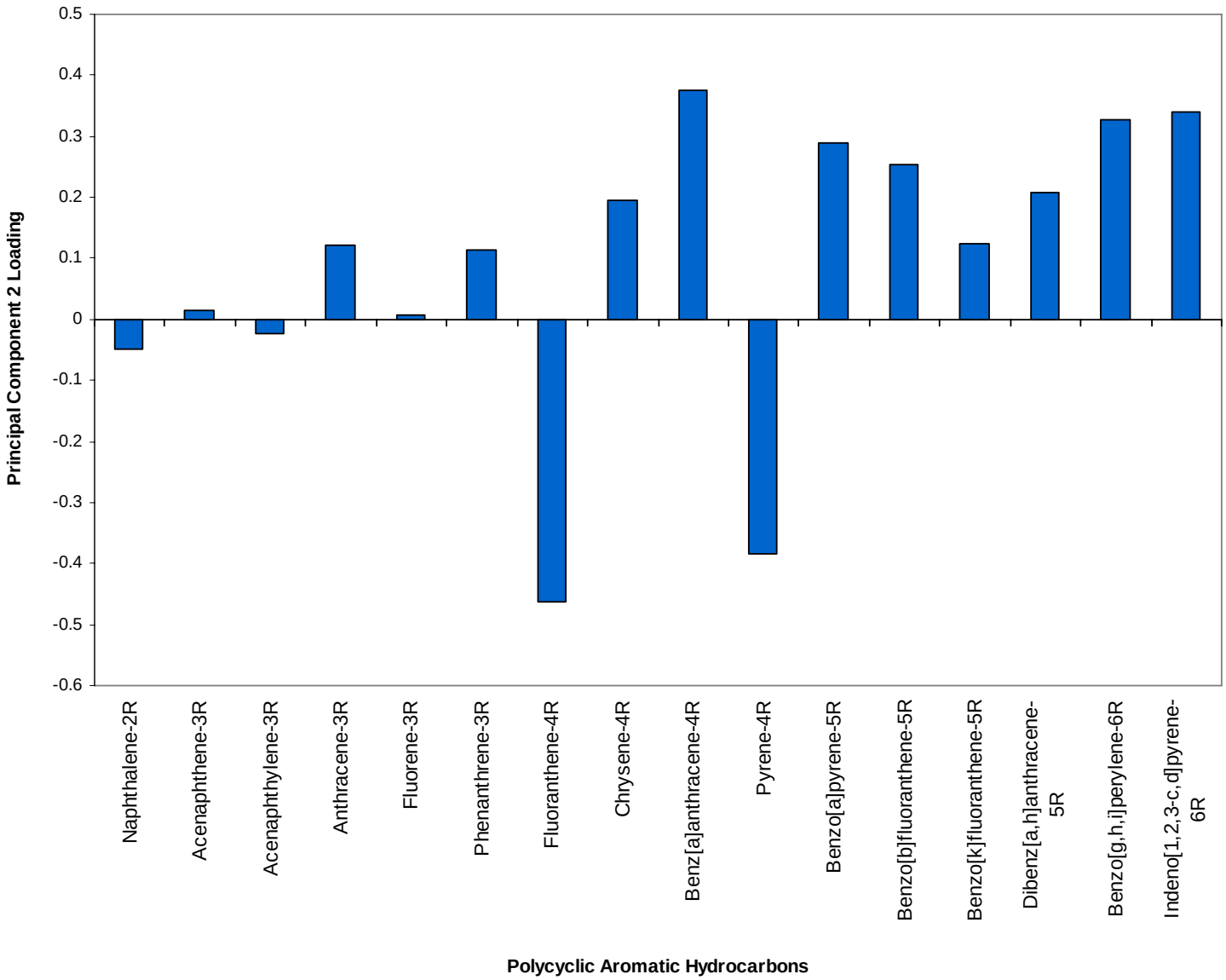
PAH Principal Component Analysis – Principle Component 1

Lower Passaic River Restoration Project

Figure 15-16a

September 2008

MALCOLM PIRNIE



Legend

Location

River Mile 1 to River Mile 7

Notes

Data Source:
Tierra Solutions, Inc. 1995 Dataset

Each individual PAH is followed by an indicator of the number of rings in that constituent. For example:

Anthracene-3R => the "3R" indicates Anthracene is a 3-ring PAH.

Chrysene-4R => the "4R" indicates that Chrysene is a 4-ring PAH.

US Army Corps of Engineers

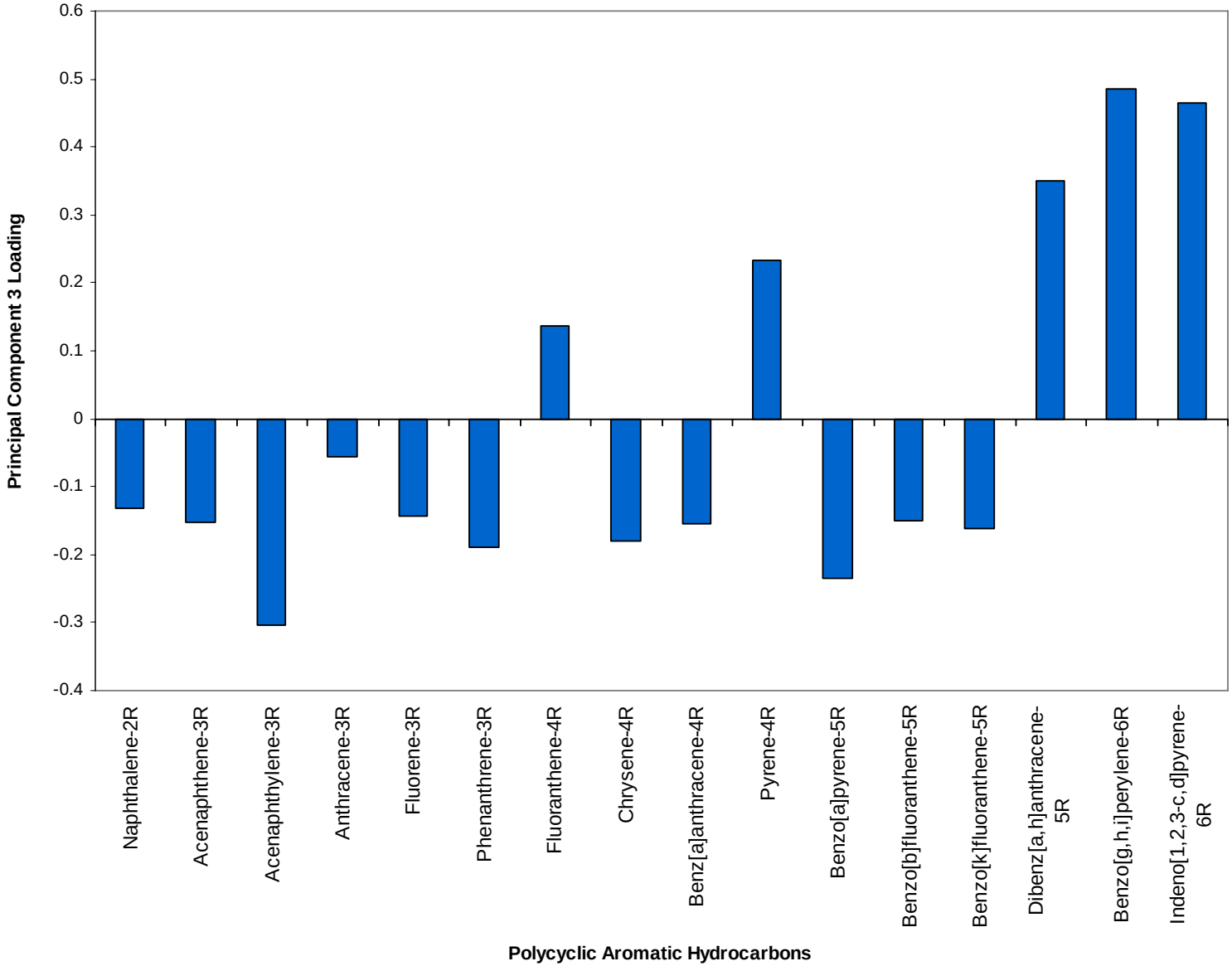
PAH Principal Component Analysis – Principle Component 2

Lower Passaic River Restoration Project

Figure 15-16b

September 2008

MALCOLM PIRNIE



Legend

Location

River Mile 1 to River Mile 7

Notes

Data Source:
Tierra Solutions, Inc. 1995 Dataset

Each individual PAH is followed by an indicator of the number of rings in that constituent. For example:

Anthracene-3R => the "3R" indicates Anthracene is a 3-ring PAH.

Chrysene-4R => the "4R" indicates that Chrysene is a 4-ring PAH.

US Army Corps of Engineers

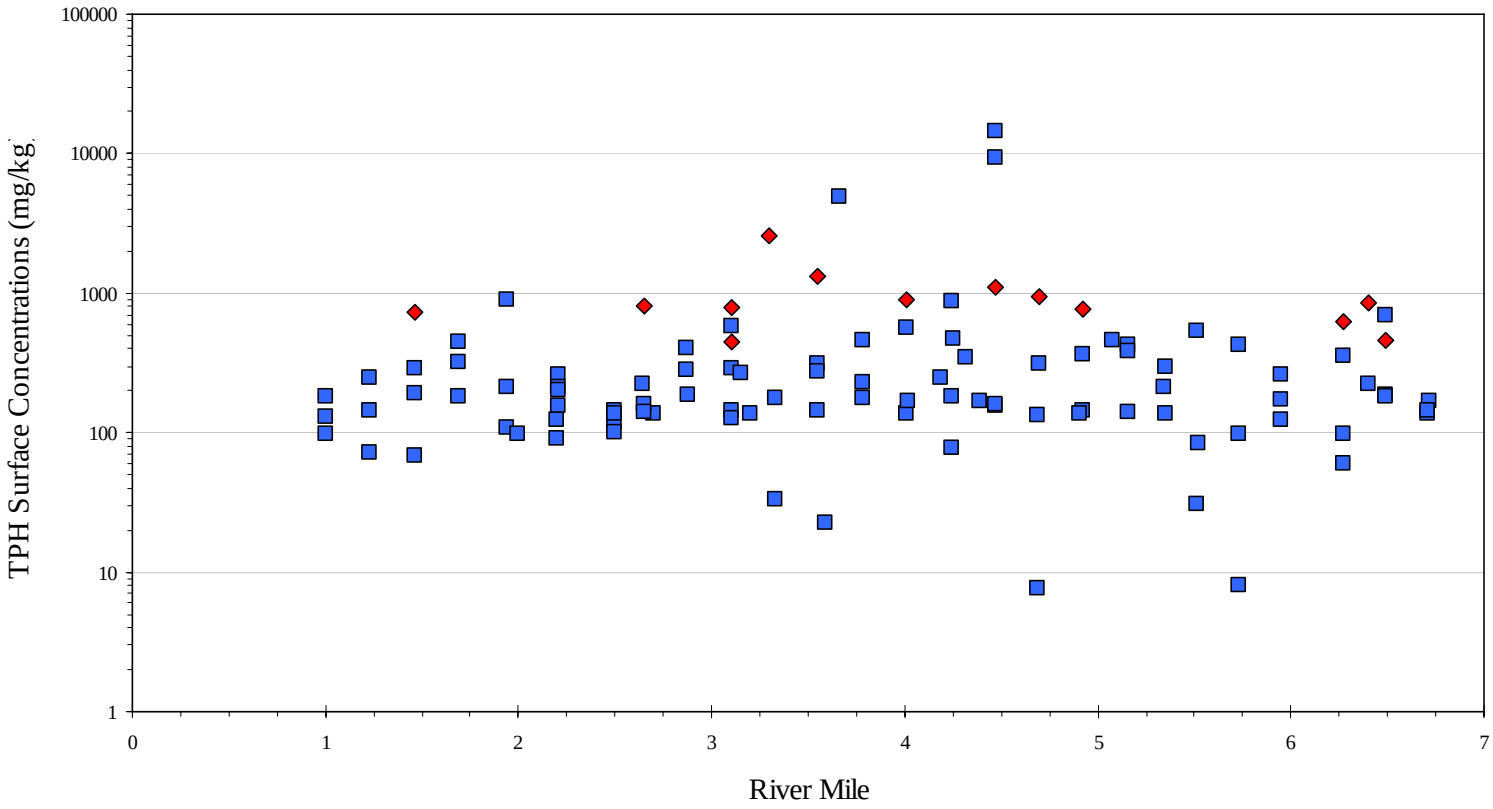
PAH Principal Component Analysis – Principle Component 3

Lower Passaic River Restoration Project

Figure 15-16c

September 2008

MALCOLM PIRNIE



Legend

- TPH Surface Concentrations (1963)
- TPH Surface Concentrations (1995)

Location

Notes

1995 Tierra Solutions Inc Dataset

"Surface Concentration 1995" = concentrations at 0 to 0.5 foot

"Concentrations at 1963" = interpolated concentration at depth of the corresponding cesium-137 peak

Non-detect (lab qualifier containing a U) plotted as half the reported detection limit

US Army Corps of Engineers

Comparison of Concentrations in 1963 and 1995, TPH

Lower Passaic River Restoration Project

Figure 15-17

September 2008

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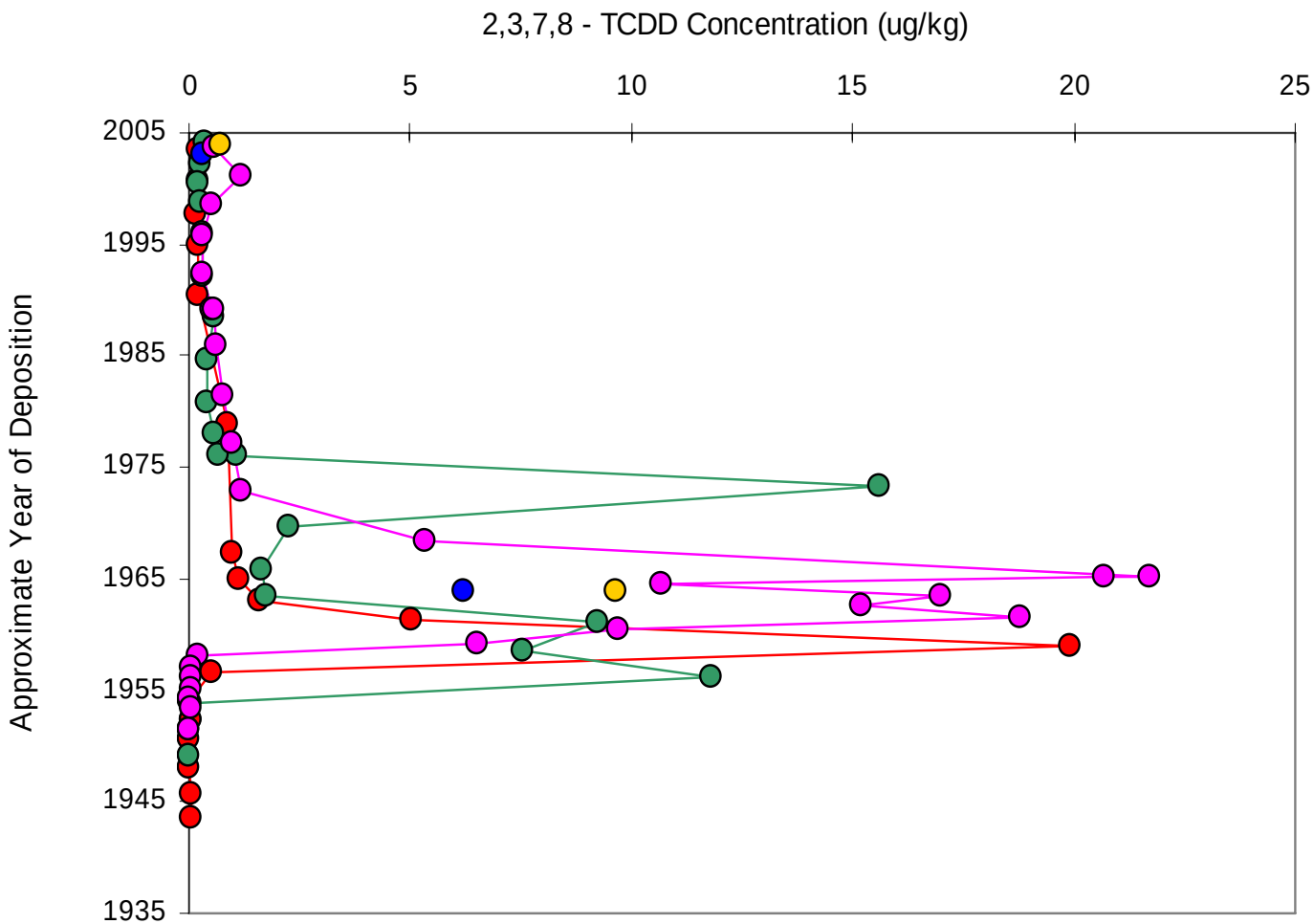


Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Nondetect concentrations plotted as zero.

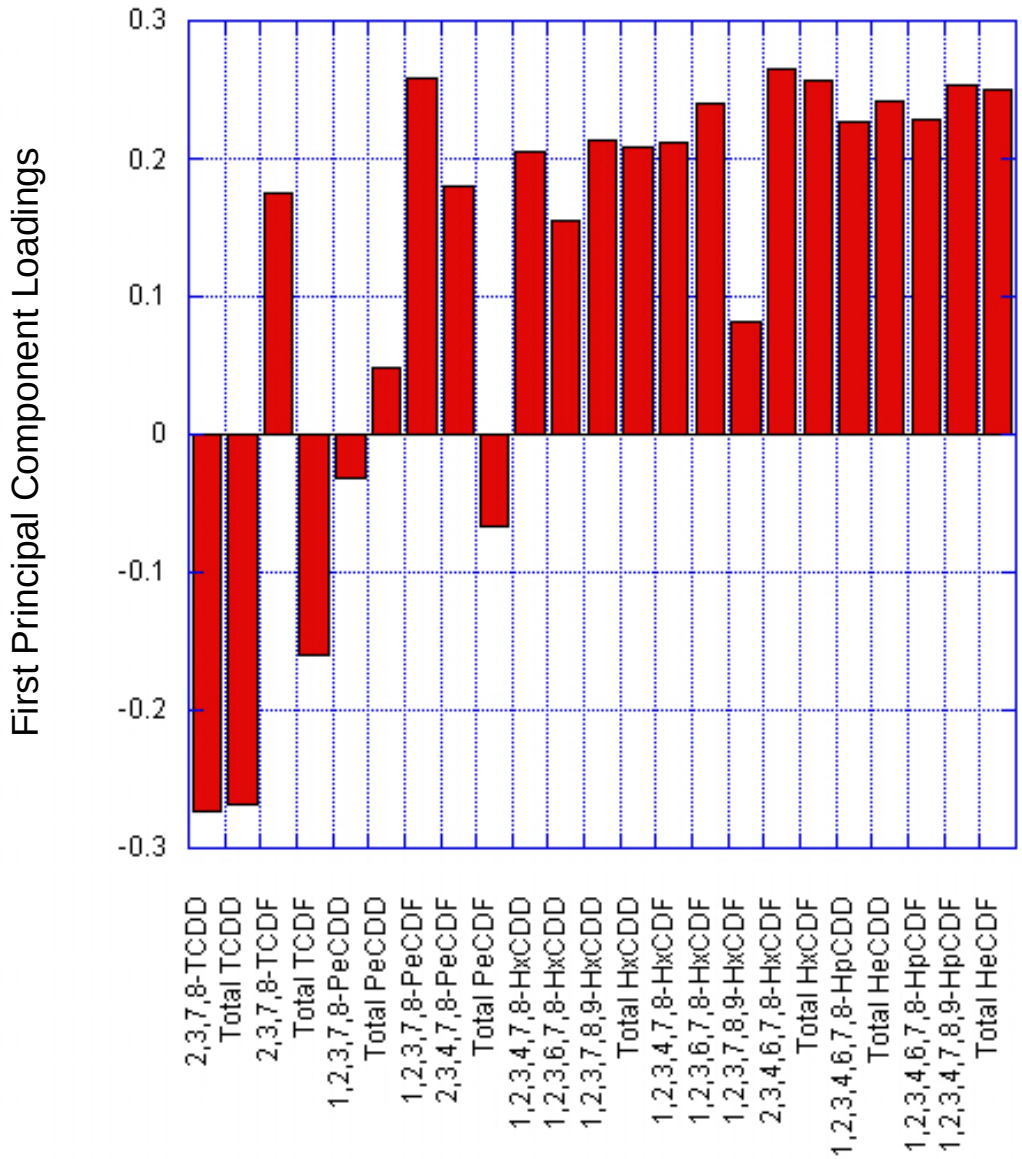
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for 2,3,7,8-TCDD Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-18

September 2008



Notes

The principal component analysis was run on all of the available tetra-, penta-, hexa- and hepta- dioxin and furan congeners and the homologue totals. Mass fractions were calculated by dividing each concentration value by the sum of all concentrations for each slice.

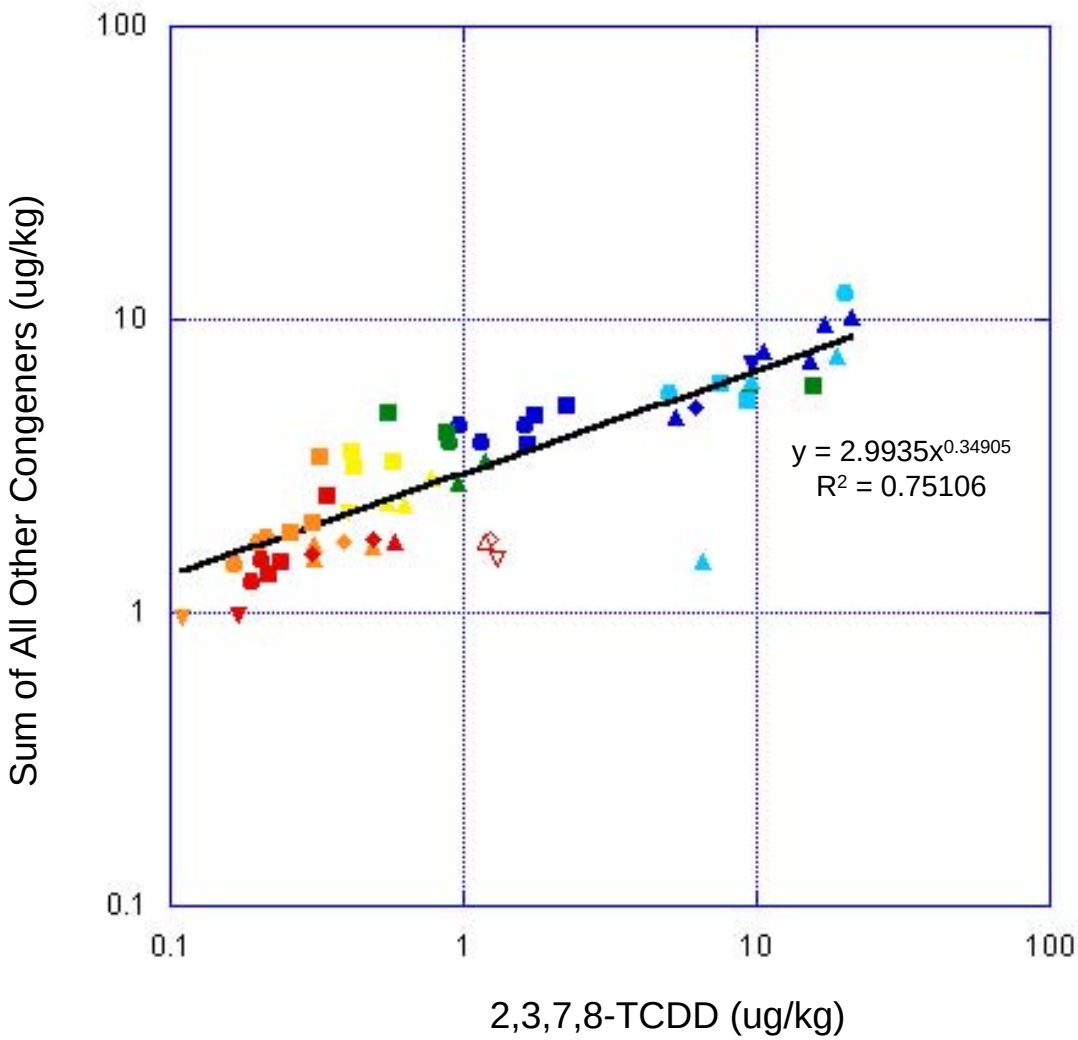
The first principal component accounts for 54% of the variance; the second principal component accounts for 16% of the variance.

First Principal Component Loadings for Dioxins and Furans in High Resolution Core Samples

Lower Passaic River Restoration Project

Figure 15-19

September 2008



Legend

High Resolution Core Slices

- River Mile 1.4
- River Mile 2.2
- River Mile 7.8
- River Mile 11
- River Mile 12.6
- 1950s
- 1960s
- 1970s
- 1980s
- 1990s
- 2000s

Slices with High Dioxin Concentration

- RM 7.8, 2001 slice
- RM 11, 2001 slice
- RM 12.6, 2001 slice
- Regression Line

Notes

Dioxin congeners include:

1,2,3,4,6,7,8-HpCDD
1,2,3,4,7,8-HxCDD
1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-HxCDD
1,2,3,7,8-PeCDD
2,3,7,8-TCDD

Furan congeners include:

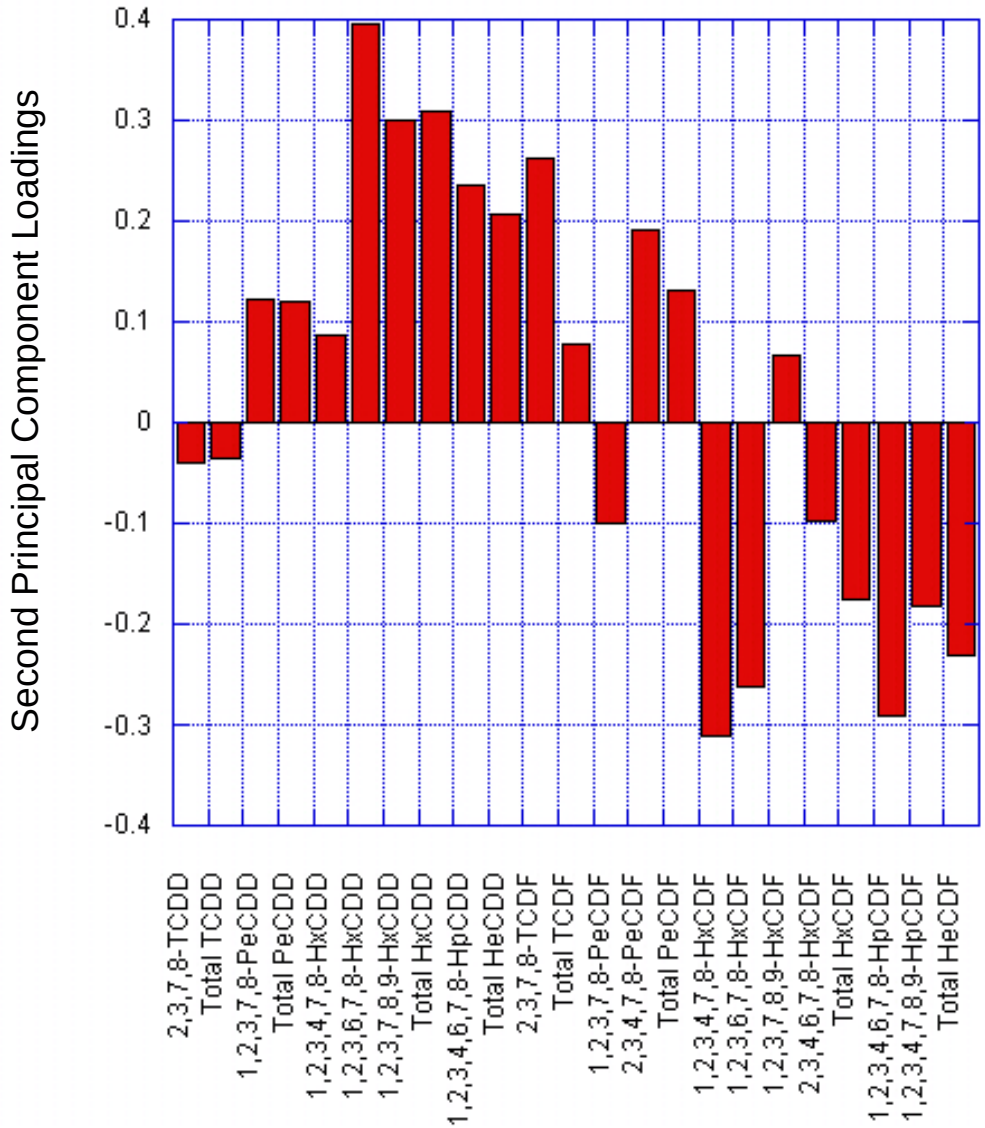
1,2,3,4,6,7,8-HpCDF
1,2,3,4,7,8,9-HpCDF
1,2,3,4,7,8-HxCDF
1,2,3,6,7,8-HxCDF
1,2,3,7,8,9-HxCDF
2,3,4,6,7,8-HxCDF
1,2,3,7,8-PeCDF
12,3,4,7,8-PeCDF
2,3,7,8-TCDF

2,3,7,8-TCDD Concentration vs. the Sum of All Other Dioxin and Furan Congeners

Lower Passaic River Restoration Project

Figure 15-20

September 2008



Notes

The principal component analysis was run on all of the available tetra-, penta-, hexa- and hepta- dioxin and furan congeners and the homologue totals. Mass fractions were calculated by dividing each concentration value by the sum of all concentrations for each slice.

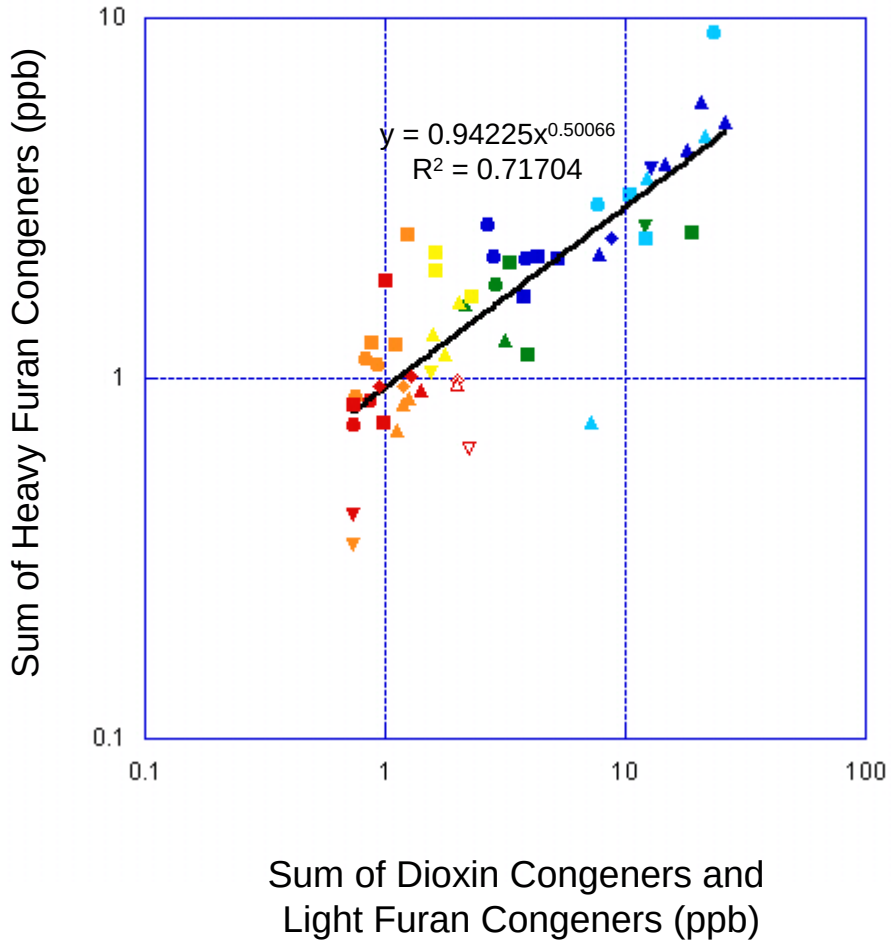
The first principal component accounts for 54% of the variance; the second principal component accounts for 16% of the variance.

Second Principal Component Loadings for Dioxins and Furans in High Resolution Core Samples

Lower Passaic River Restoration Project

Figure 15-21

September 2008



Legend

High Resolution Core Slices

- River Mile 1.4
- River Mile 2.2
- River Mile 7.8
- River Mile 11
- River Mile 12.6
- 1950s
- 1960s
- 1970s
- 1980s
- 1990s
- 2000s

Slices with High Dioxin Concentration

- RM 7.8, 2001 slice
- RM 11, 2001 slice
- RM 12.6, 2001 slice

Regression Line

Notes

Dioxin congeners and light furan congeners include:

1,2,3,4,6,7,8-HpCDD
1,2,3,4,7,8-HxCDD
1,2,3,6,7,8-HxCDD
1,2,3,7,8,9-HxCDD
1,2,3,7,8-PeCDD
2,3,7,8-TCDD
1,2,3,7,8-PeCDF
12,3,4,7,8-PeCDF
2,3,7,8-TCDF

Heavy furan congeners include:

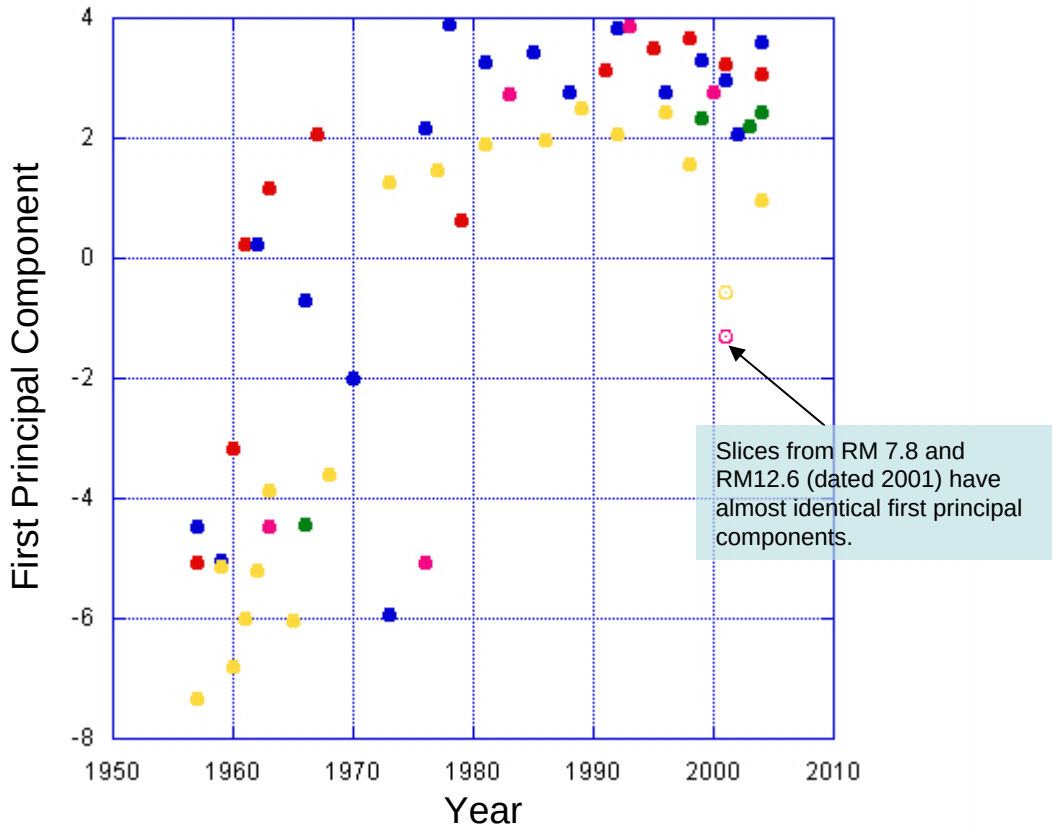
1,2,3,4,6,7,8-HpCDF
1,2,3,4,7,8,9-HpCDF
1,2,3,4,7,8-HxCDF
1,2,3,6,7,8-HxCDF
1,2,3,7,8,9-HxCDF
2,3,4,6,7,8-HxCDF

Comparison of Dioxin and Furan Congener Concentrations in High Resolution Core Samples

Lower Passaic River Restoration Project

Figure 15-22

September 2008



Legend

High Resolution Core Slices

- River Mile 1.4
- River Mile 2.2
- River Mile 7.8
- River Mile 11
- River Mile 12.6

Slices with High Dioxin Concentration

- RM 7.8, 2001 slice
- RM 11, 2001 slice
- RM 12.6, 2001 slice

Notes

The principal component analysis was run on all of the available tetra-, penta-, hexa- and hepta- dioxin and furan congeners and the homologue totals. Mass fractions were calculated by dividing each concentration value by the sum of all concentrations for each slice.

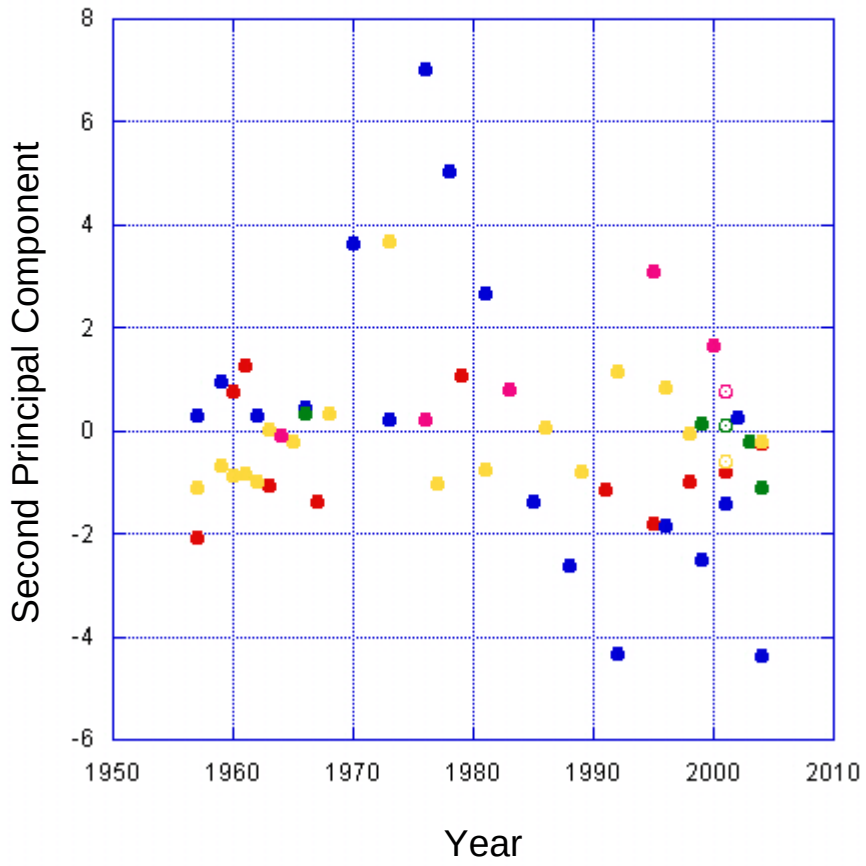
The first principal component accounts for 54% of the variance; the second principal component accounts for 16% of the variance.

First Principal Component *vs.* Approximate Year of Deposition for High Resolution Core Samples

Lower Passaic River Restoration Project

Figure 15-23

September 2008



Legend

High Resolution Core Slices

- River Mile 1.4
- River Mile 2.2
- River Mile 7.8
- River Mile 11
- River Mile 12.6

Slices with High Dioxin Concentration

- RM 7.8, 2001 slice
- RM 11, 2001 slice
- RM 12.6, 2001 slice

Notes

The principal component analysis was run on all of the available tetra-, penta-, hexa- and hepta- dioxin and furan congeners and the homologue totals. Mass fractions were calculated by dividing each concentration value by the sum of all concentrations for each slice.

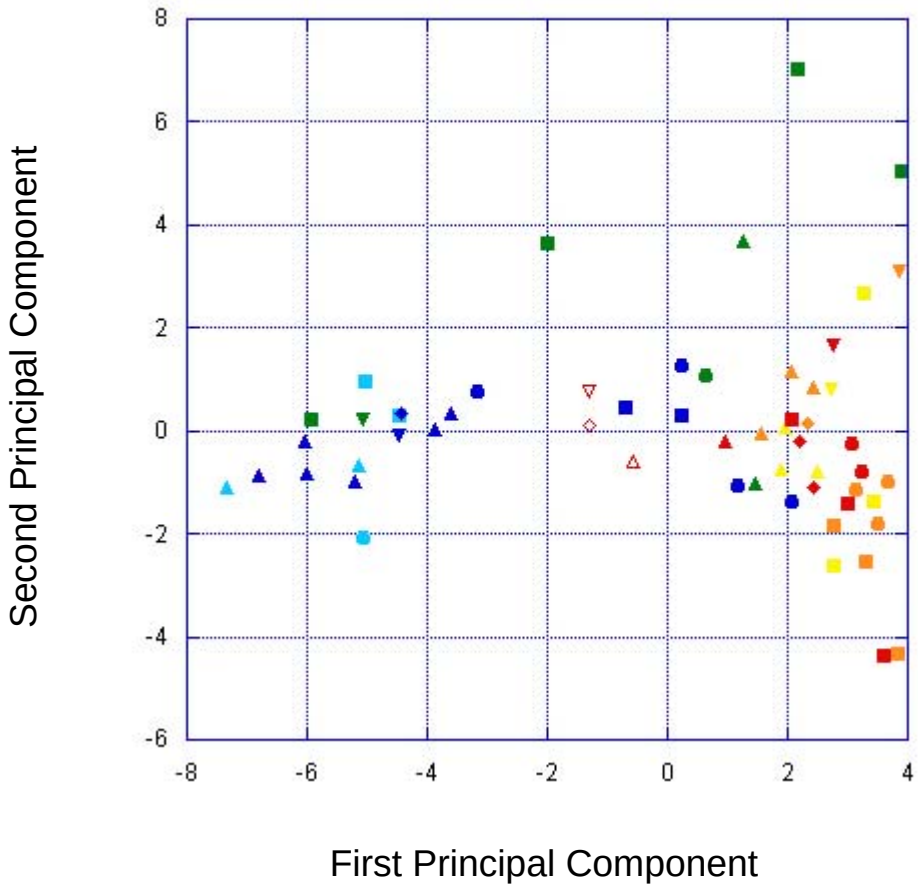
The first principal component accounts for 54% of the variance; the second principal component accounts for 16% of the variance.

Second Principal Component *vs.* Approximate Year of Deposition for High Resolution Core Samples

Lower Passaic River Restoration Project

Figure 15-24

September 2008



Legend

High Resolution Core Slices

- River Mile 1.4
- River Mile 2.2
- River Mile 7.8
- River Mile 11
- River Mile 12.6
- 1950s
- 1960s
- 1970s
- 1980s
- 1990s
- 2000s

Slices with High Dioxin Concentration

- RM 7.8, 2001 slice
- RM 11, 2001 slice
- RM 12.6, 2001 slice

Notes

The principal component analysis was run on all of the available tetra-, penta-, hexa- and hepta- dioxin and furan congeners and the homologue totals. Mass fractions were calculated by dividing each concentration value by the sum of all concentrations for each slice.

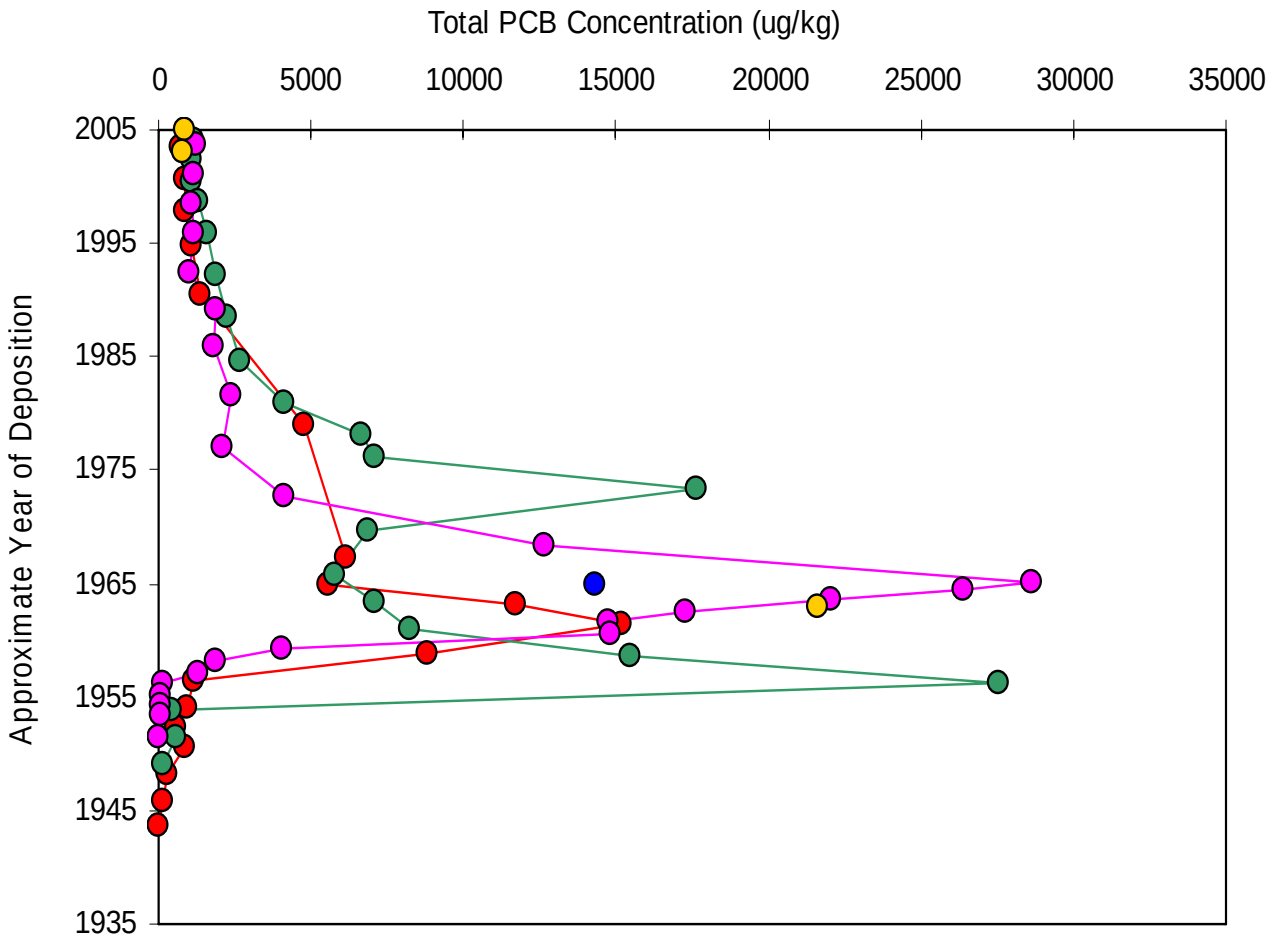
The first principal component accounts for 54% of the variance; the second principal component accounts for 16% of the variance.

First and Second Principal Components for High Resolution Core Samples

Lower Passaic River Restoration Project

Figure 15-25

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Total PCB equals sum of 209 congeners with nondetected PCB congener concentrations equal to zero.

Nondetect concentrations plotted as zero.

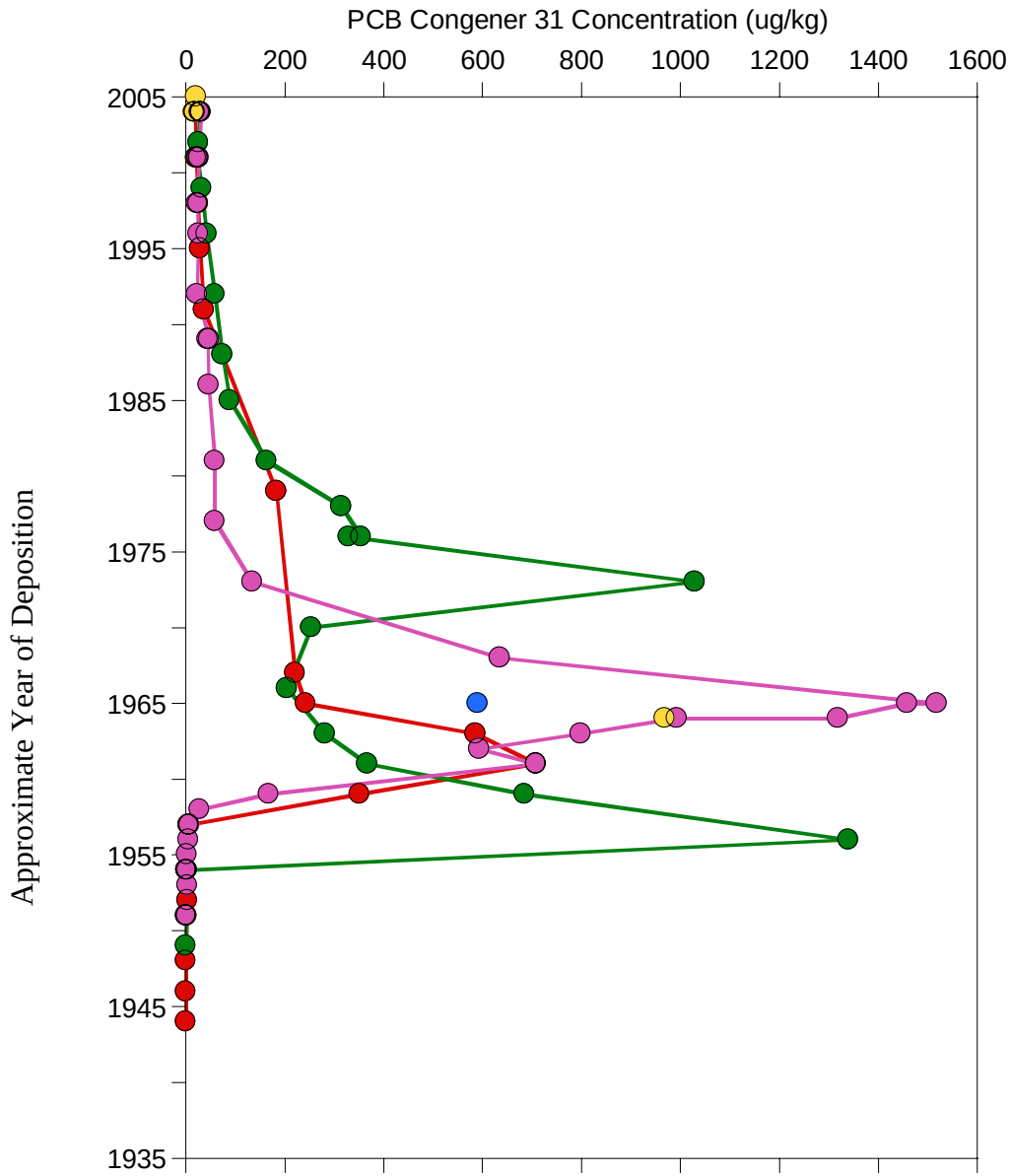
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for Total PCB Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-26a

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Nondetect concentrations plotted as zero.

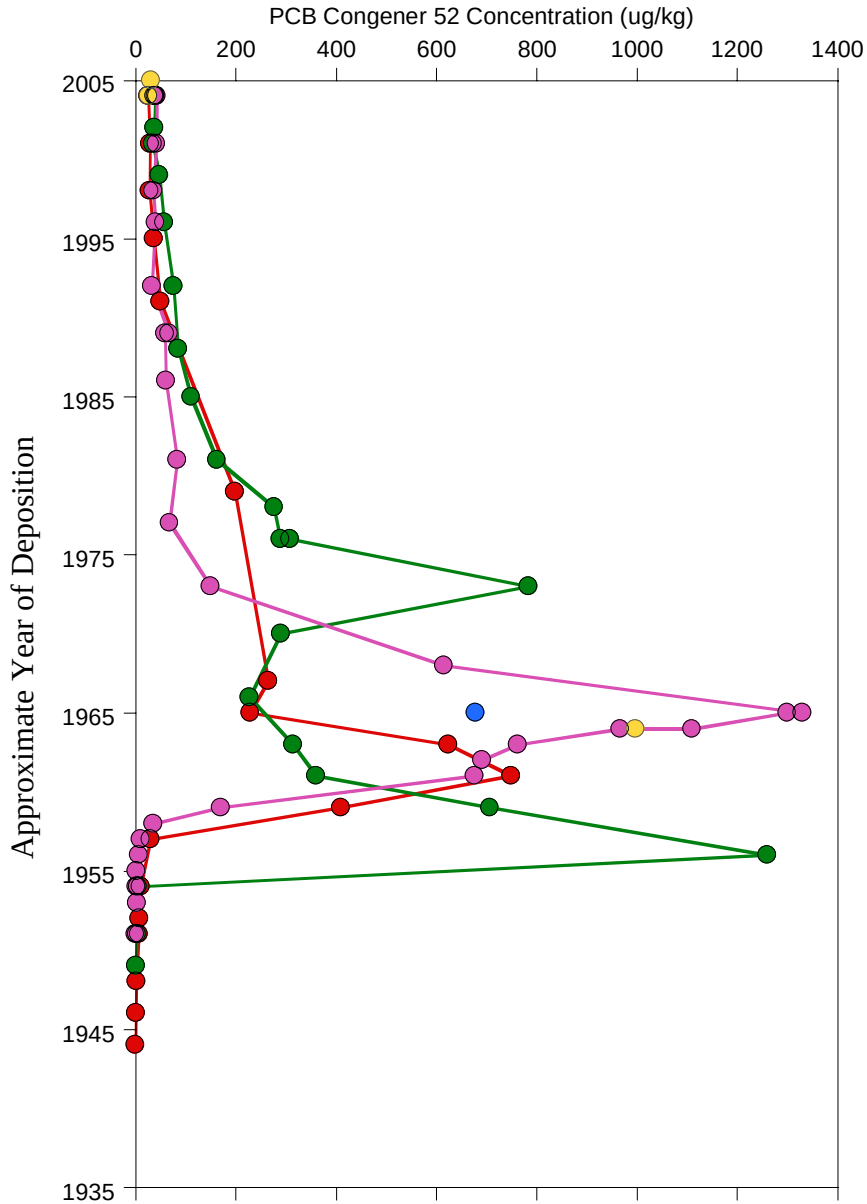
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for PCB Congener 31 Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-26b

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Nondetect concentrations plotted as zero.

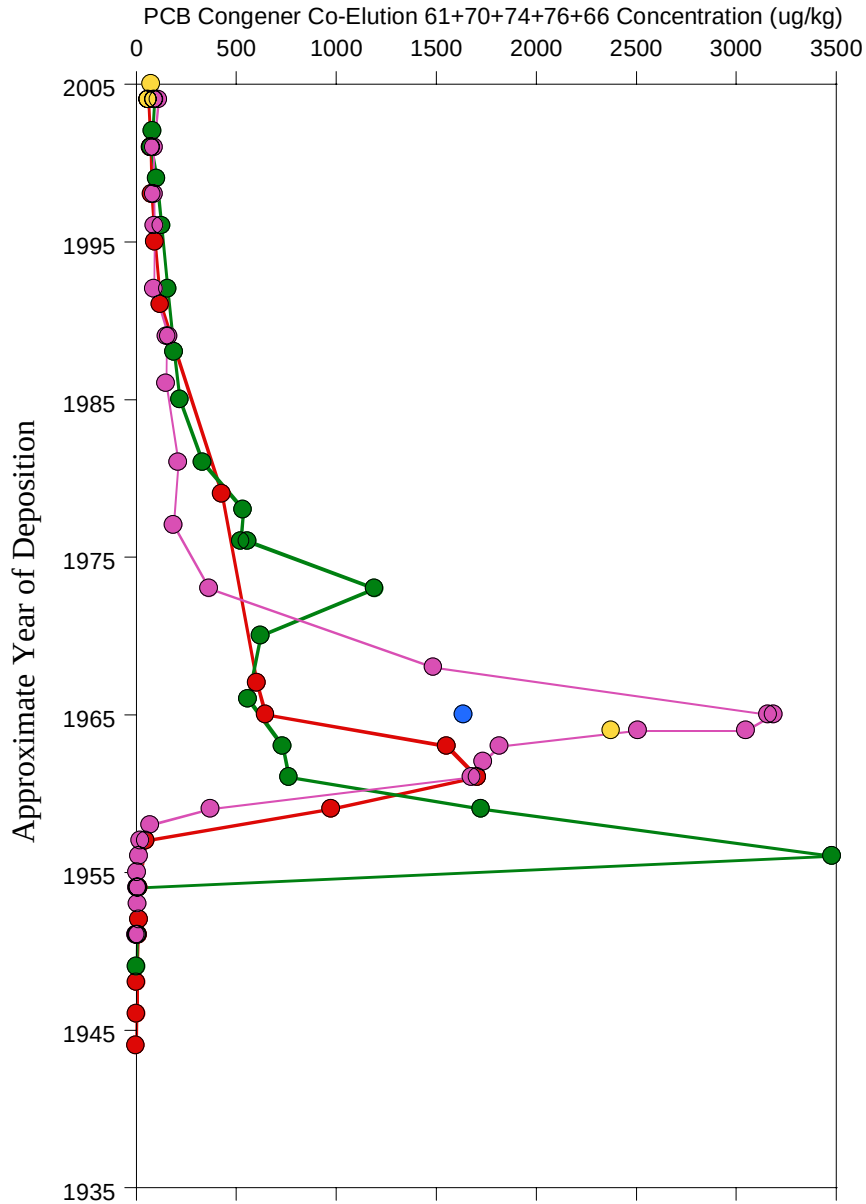
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for PCB Congener 52 Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-26c

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Nondetect concentrations plotted as zero.

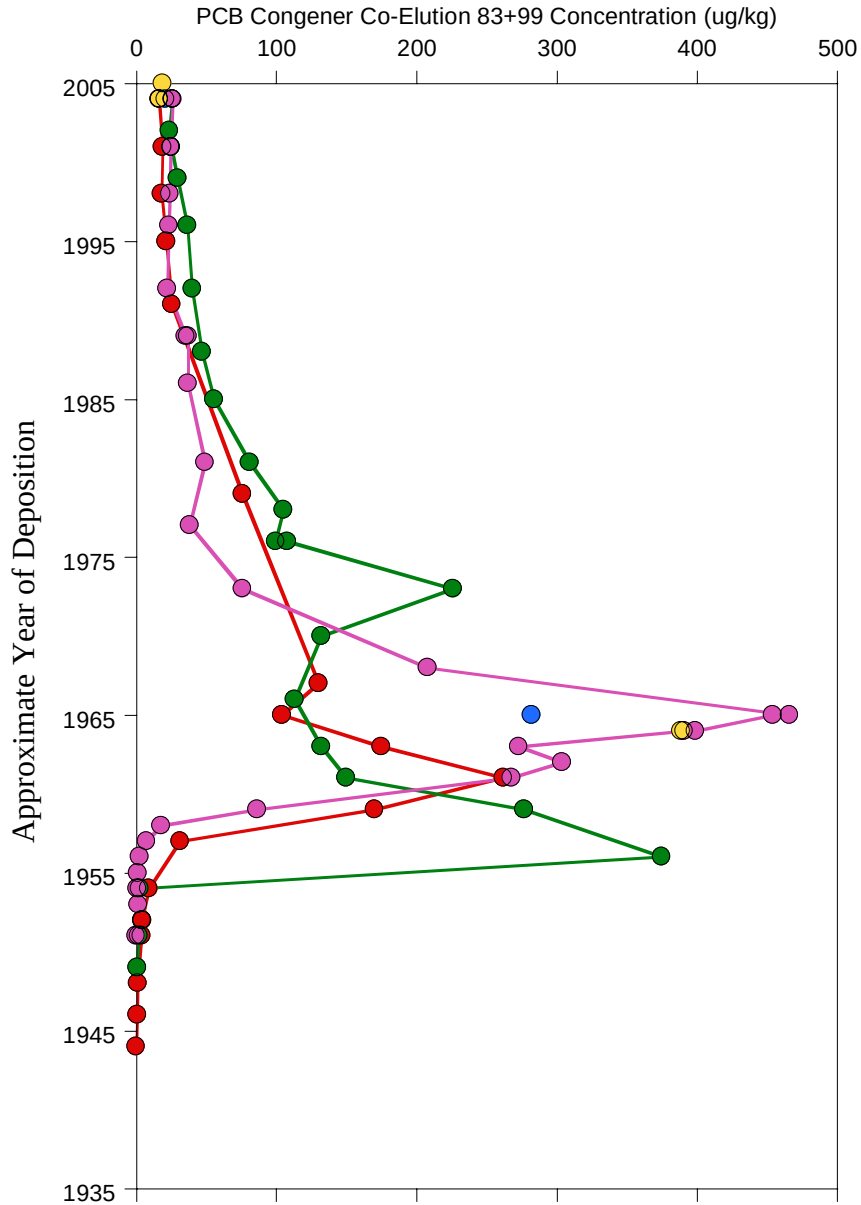
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for PCB Congener Co-elution 61+70+74+76+66 Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-26d

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Nondetect concentrations plotted as zero.

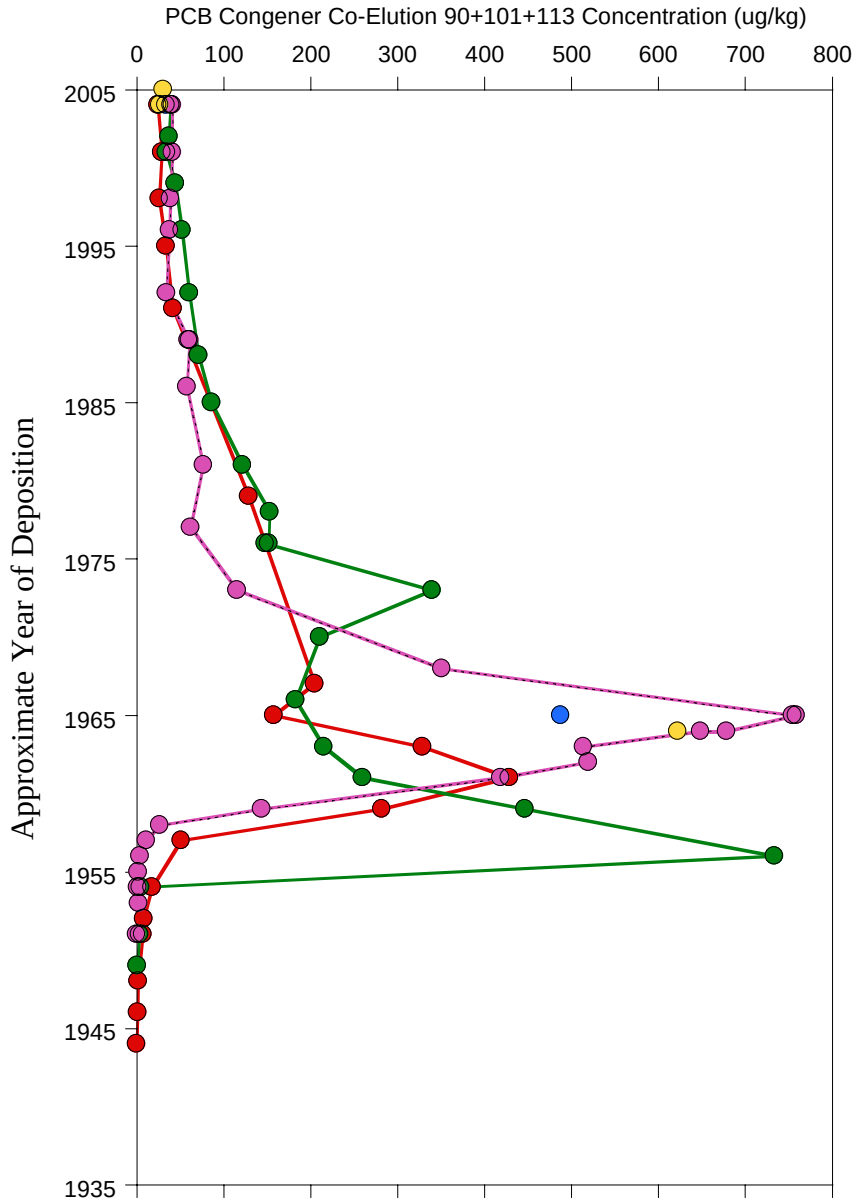
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for PCB Congener Co-elution 83+99 Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-26e

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Nondetect concentrations plotted as zero.

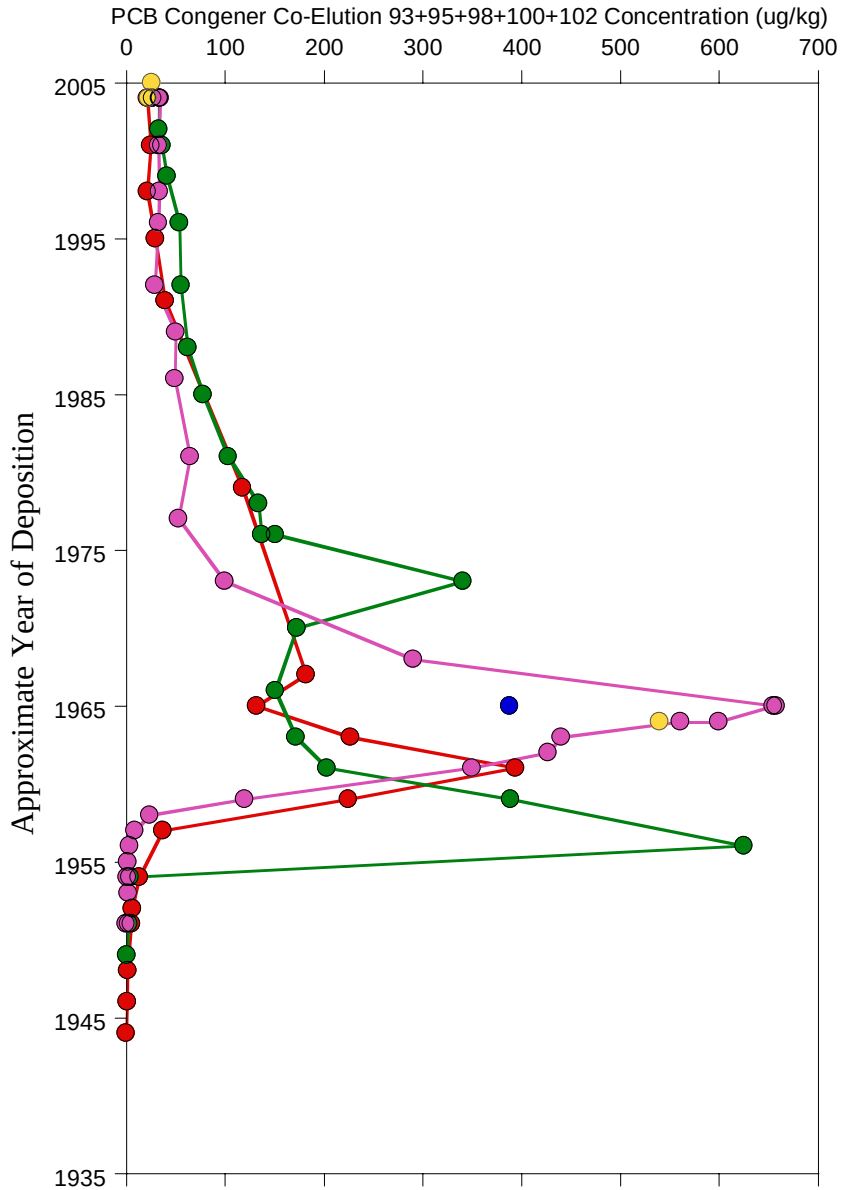
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for PCB Congener Co-elution 90+101+113 Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-26f

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Nondetect concentrations plotted as zero.

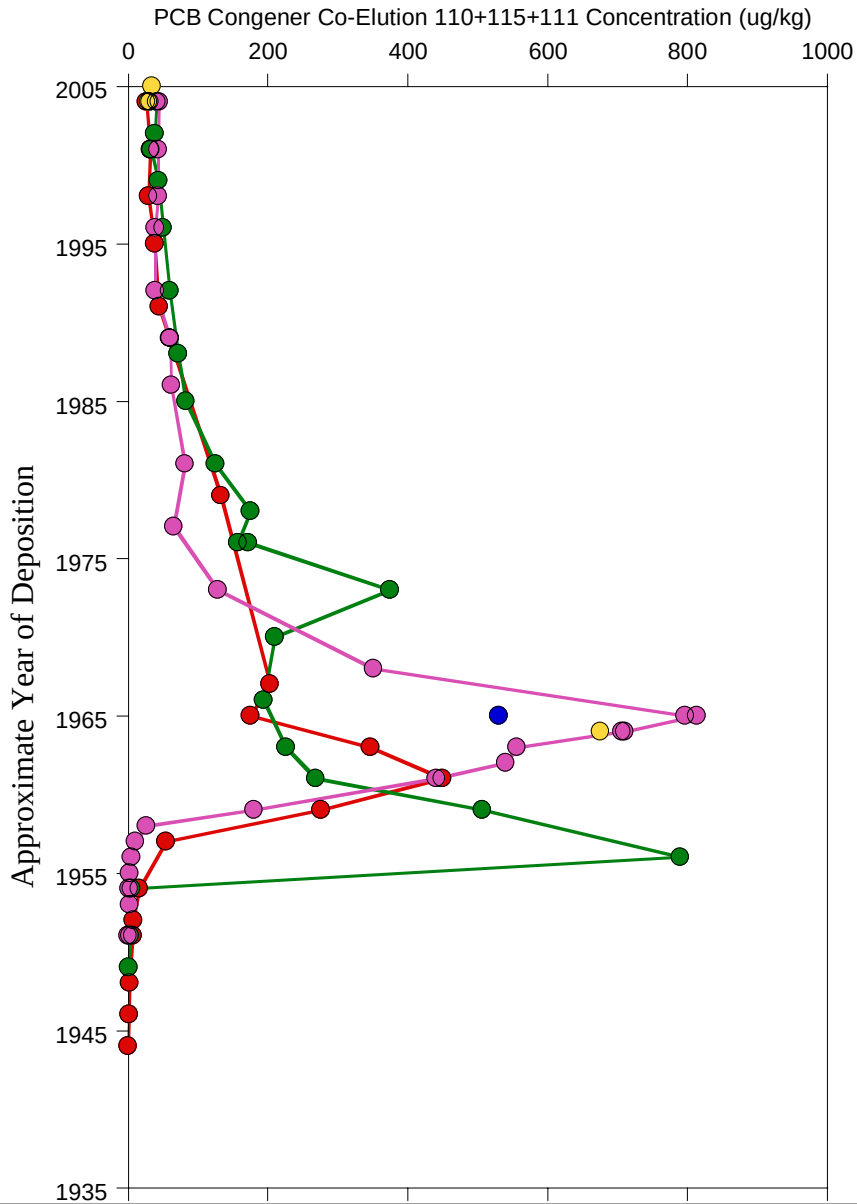
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for PCB Congener Co-elution 93+95+98+100+102 Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-26g

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Nondetect concentrations plotted as zero.

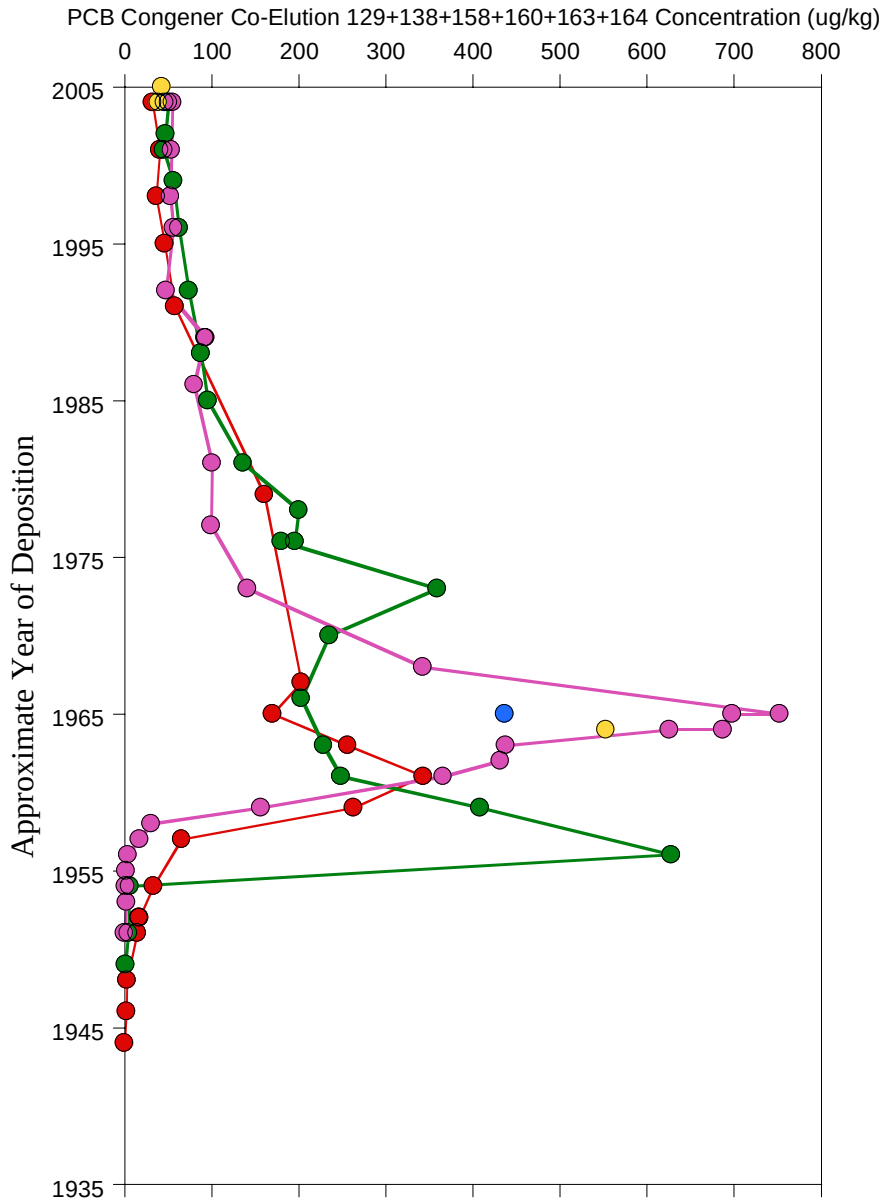
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for PCB Congener Co-elution 110+115+111 Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-26h

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Nondetect concentrations plotted as zero.

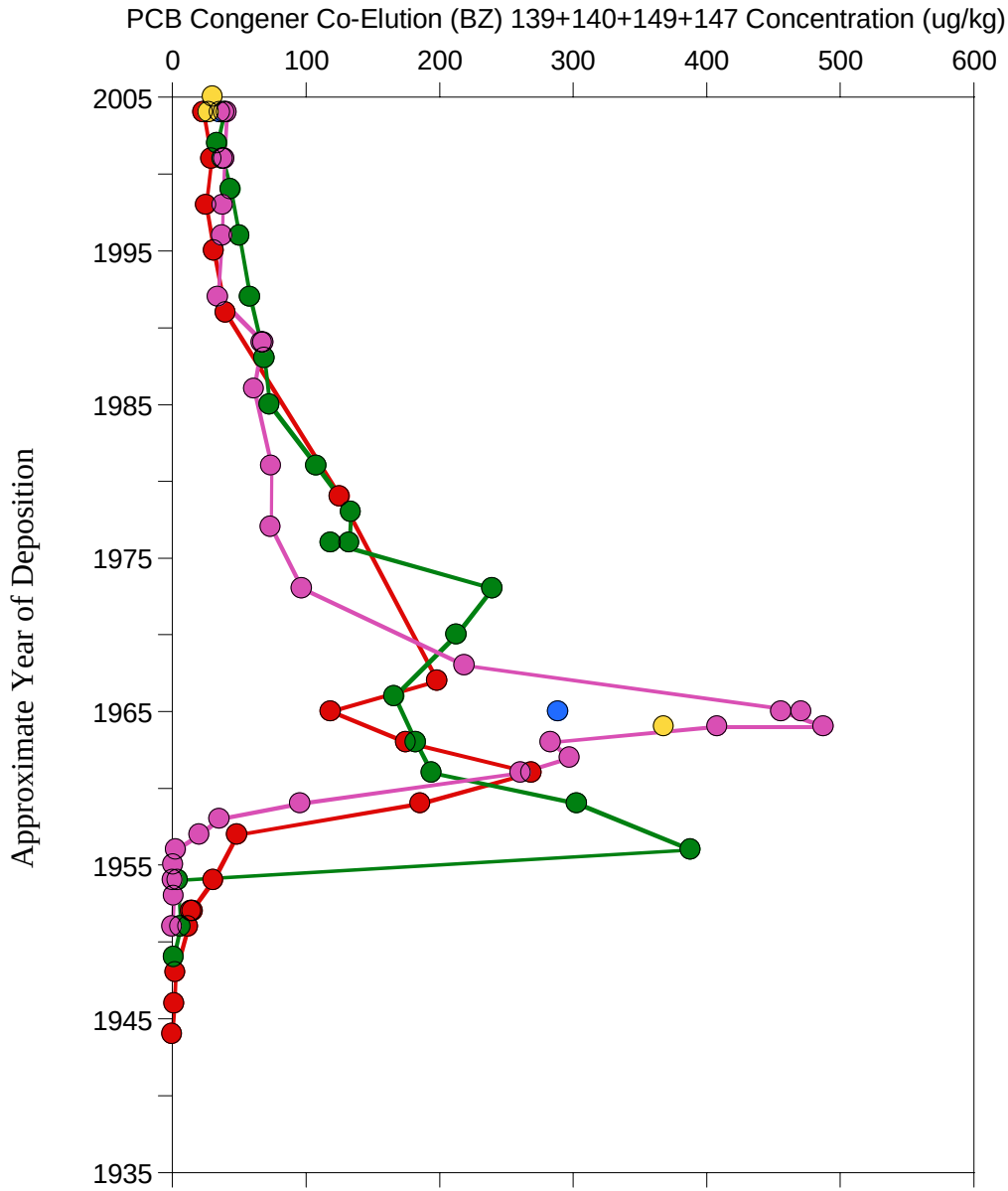
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for PCB Congener Co-elution 129+138+158+160+163+164 Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-26i

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Nondetect concentrations plotted as zero.

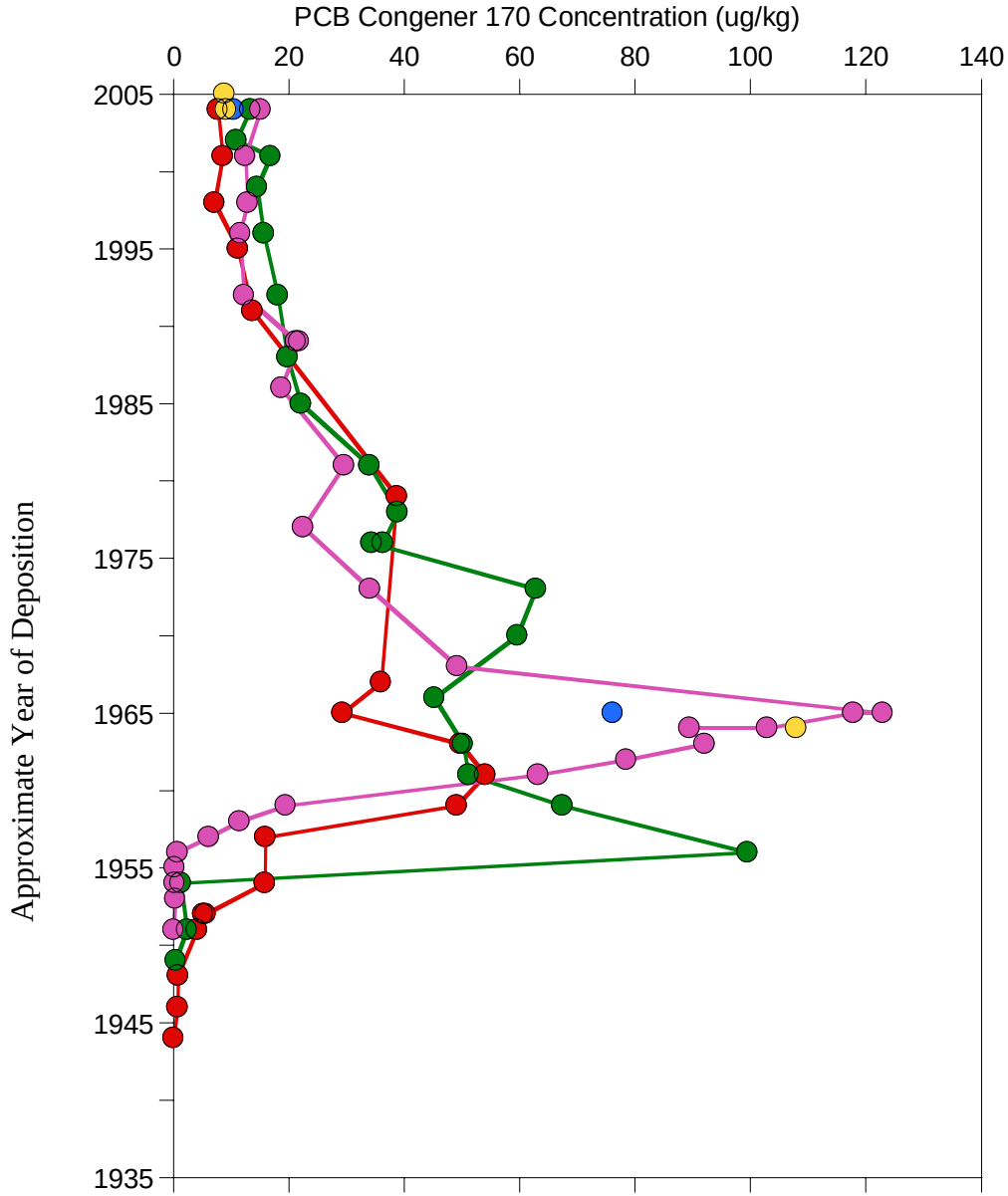
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for PCB Congener Co-elution 139+140+149+147 Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-26j

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Nondetect concentrations plotted as zero.

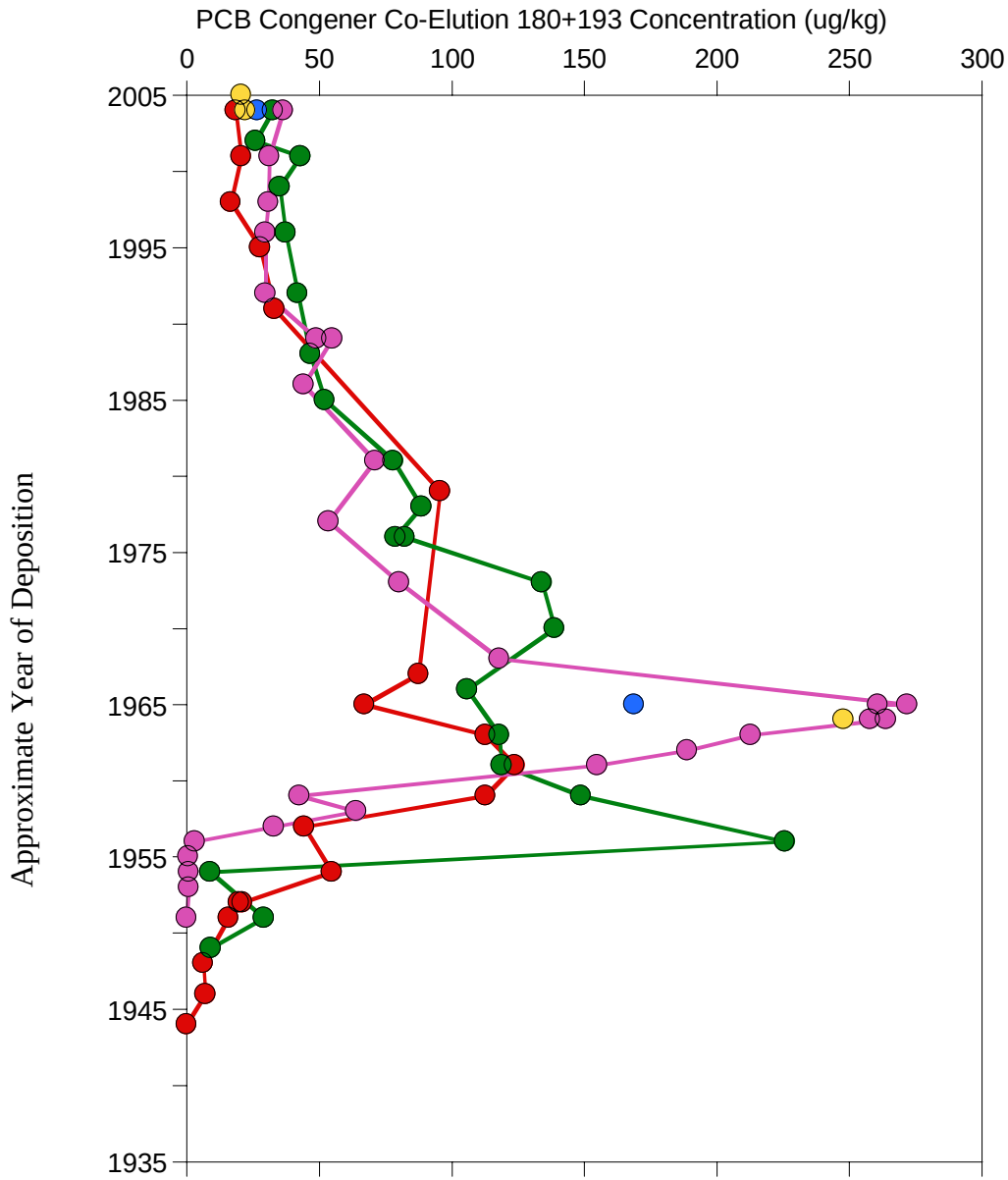
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for PCB Congener 170 Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-26k

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Nondetect concentrations plotted as zero.

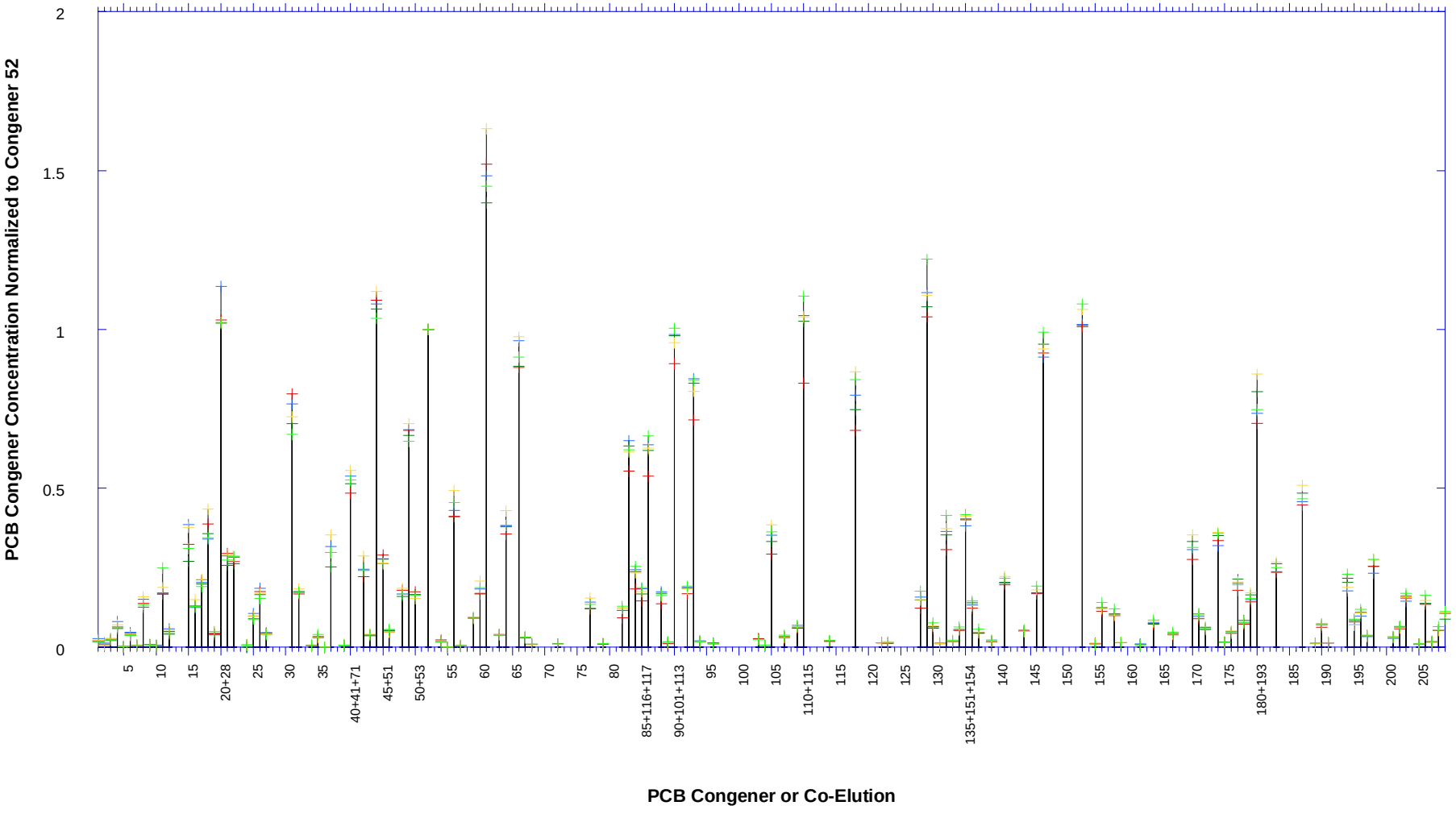
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for PCB Congener Co-elution 180+193 Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-26l

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Normalized PCB congener concentration <0.01 are not plotted.

PCB Congeners Concentration Normalized to Congener 52 for the Lower Passaic River High Resolution Cores Surface Sediments

Lower Passaic River Restoration Project

Figure 15-27

September 2008

3/22/2007 8:50AM

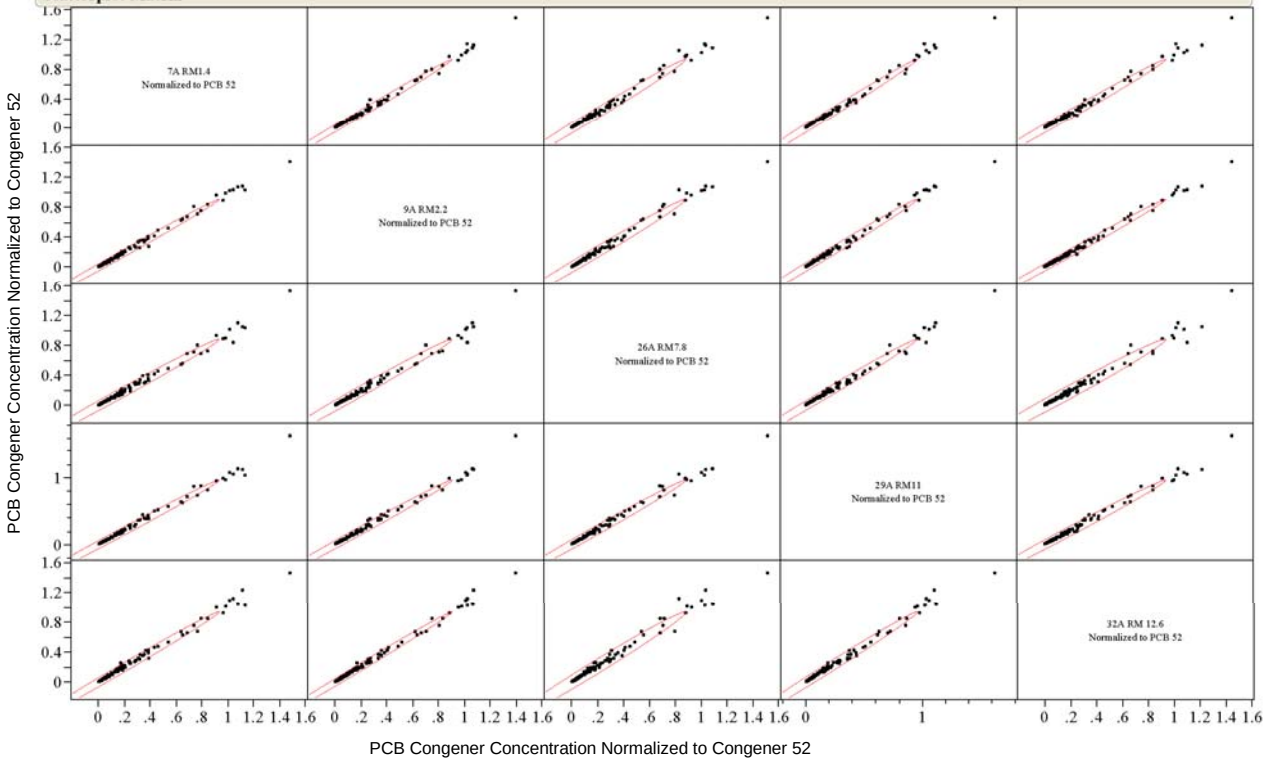
Multivariate LPR High Res Core Tops All Data

Correlations

	7A RM1.4 Normalized to PCB 52	9A RM2.2 Normalized to PCB 52	26A RM7.8 Normalized to PCB 52	29A RM11 Normalized to PCB 52	32A RM 12.6 Normalized to PCB 52
7A RM1.4 Normalized to PCB 52	1.0000	0.9975	0.9950	0.9965	0.9963
9A RM2.2 Normalized to PCB 52	0.9975	1.0000	0.9940	0.9963	0.9974
26A RM7.8 Normalized to PCB 52	0.9950	0.9940	1.0000	0.9953	0.9908
29A RM11 Normalized to PCB 52	0.9965	0.9963	0.9953	1.0000	0.9951
32A RM 12.6 Normalized to PCB 52	0.9963	0.9974	0.9908	0.9951	1.0000

24 rows not used due to missing or excluded values or frequency or weight variables missing, negative or less than one.

Scatterplot Matrix



Legend

- PCB Congeners Concentration Normalized to Congener 52

Notes

Identification numbers 7A, 9A, 26A, 29A, and 32A correspond to field location numbers of 2005 USEPA High Resolution Sediment Cores.

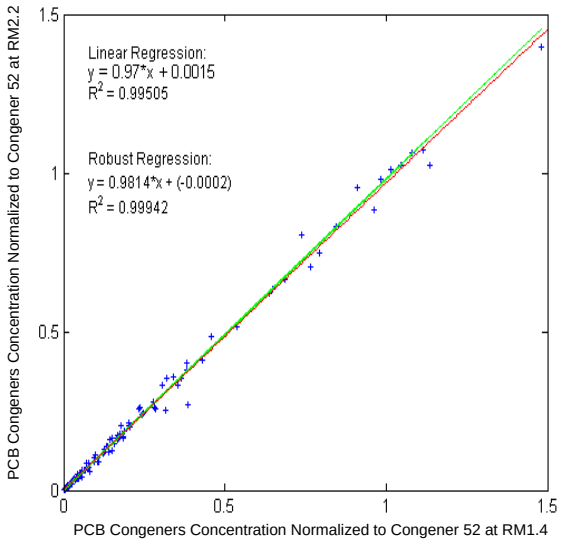
Data Source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

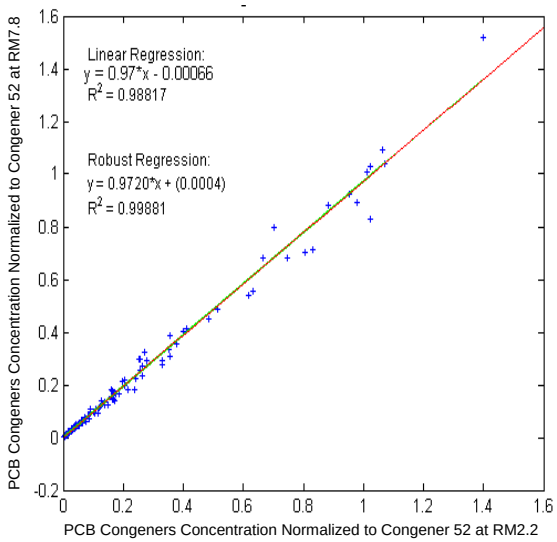
Correlation Among Sampling Locations for PCB Congeners of the Lower Passaic River High Resolution Cores Surface Sediments

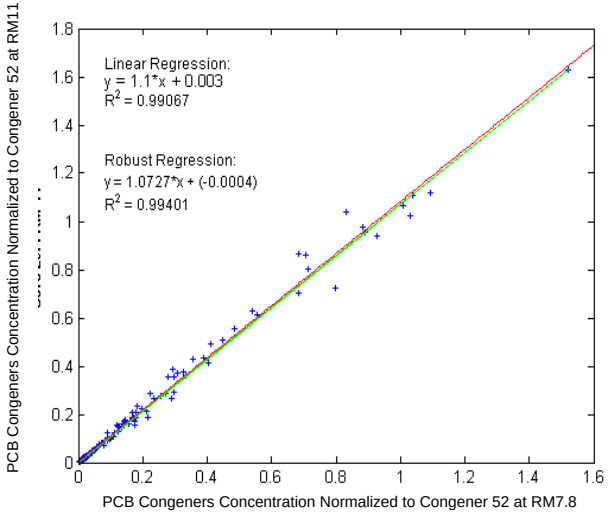
Lower Passaic River Restoration Project

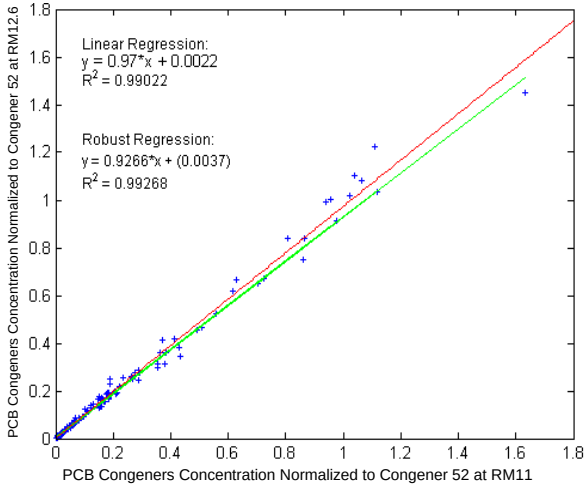
Figure 15-28

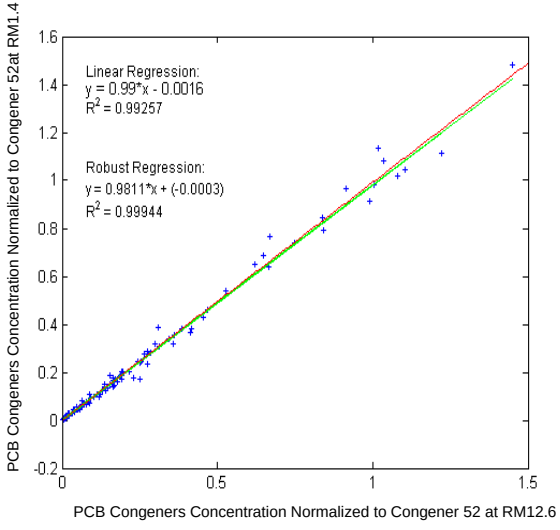
September 2008











Legend

- PCB Congeners Concentration Normalized to Congener 52
- Linear Regression
- Robust Regression

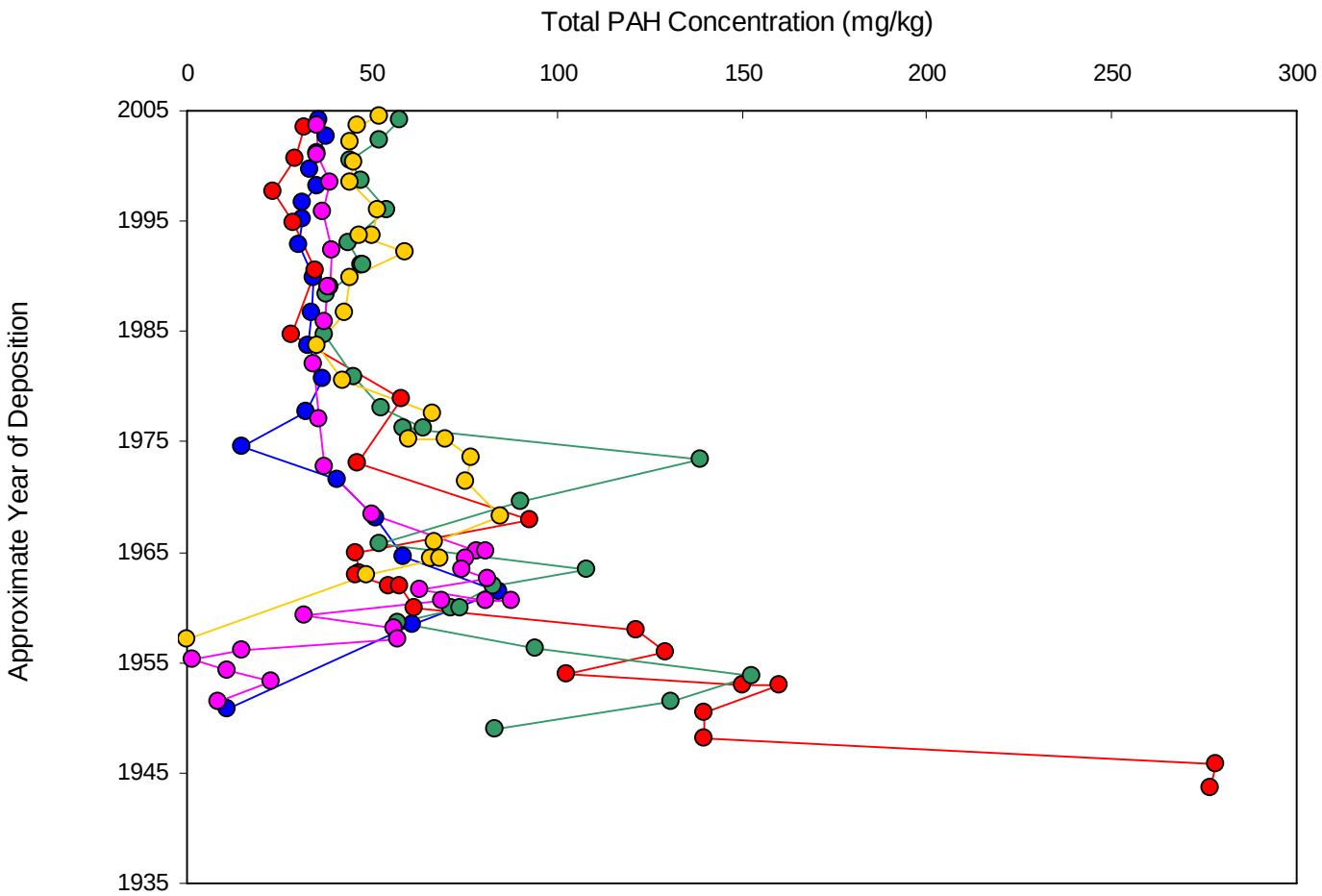
Notes

Linear and Robust Regression for PCB Congeners Concentration Normalized to Congener 52 in the Lower Passaic River High Resolution Core Surface Sediments

Lower Passaic River Restoration Project

Figure 15-29

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Total PAH equals the sum of 16 priority PAH compound with nondetect PAH compounds equal to zero.

Nondetect concentrations plotted as zero.

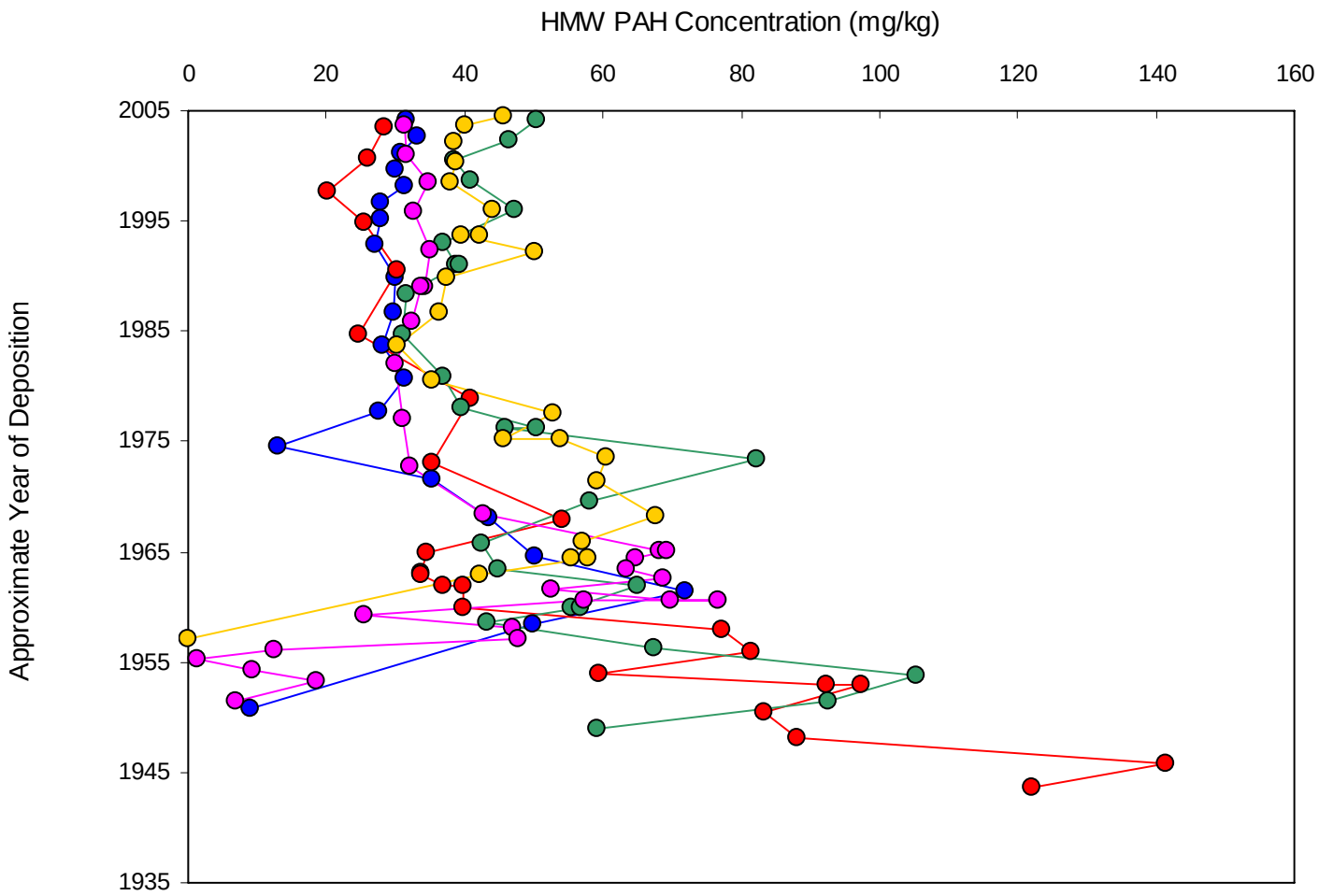
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for Total PAH Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-30a

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

HMW = High Molecular Weight

HMW PAH equals the sum of 4-ring, 5-ring, and 6-ring PAH compounds.

Nondetect concentrations plotted as zero.

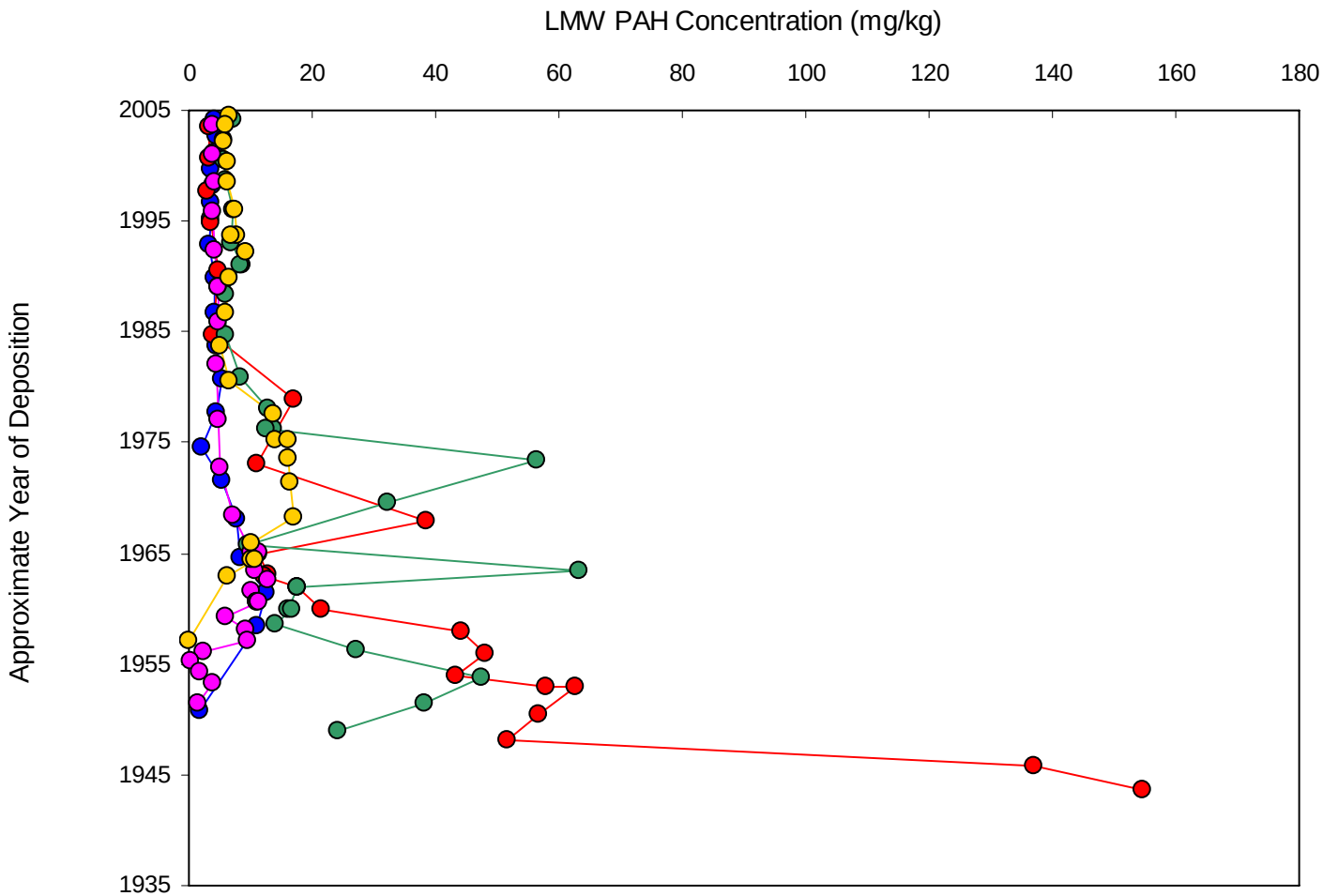
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for HMW PAH Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-30b

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

LMW = Low Molecular Weight

LMW PAH equals the sum of 2-ring and 3-ring PAH compounds.

Nondetect concentrations plotted as zero.

Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for LMW PAH Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-30c

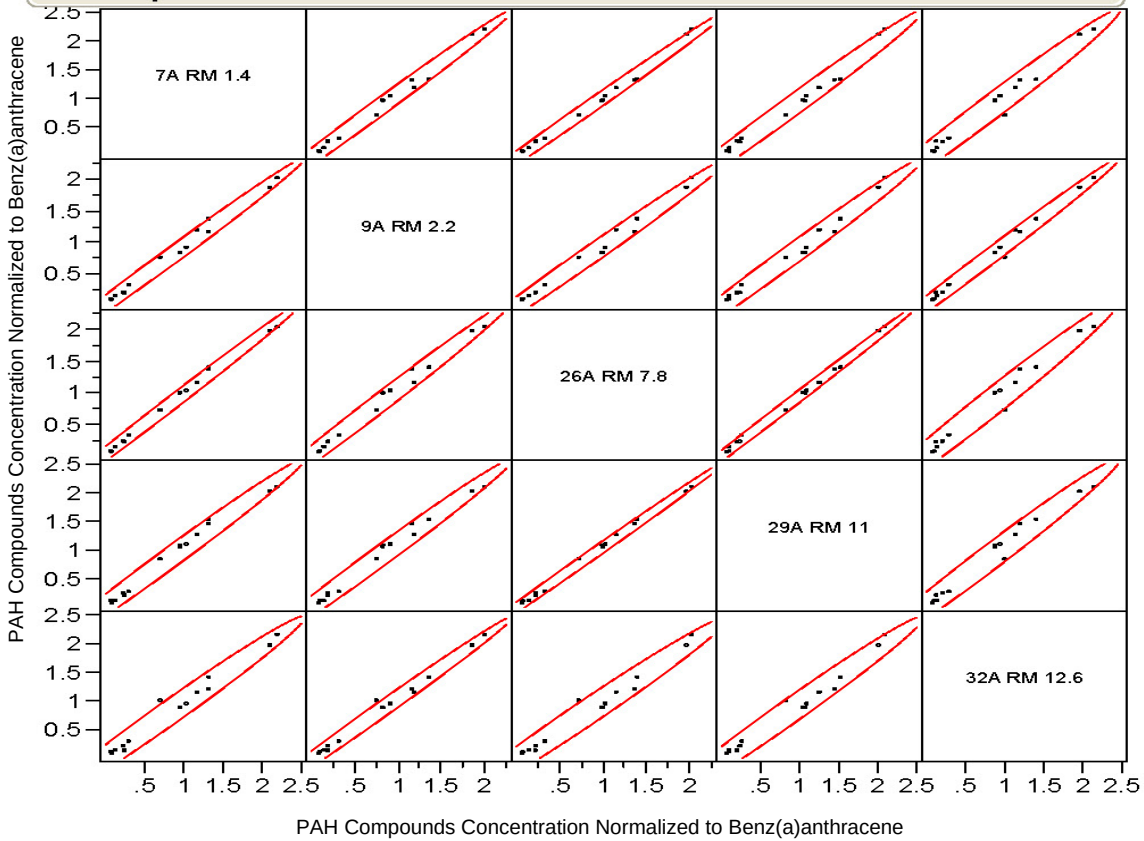
September 2008

Multivariate Passaic PAHs Normalized to BaA

Correlations

	7A RM 1.4	9A RM 2.2	26A RM 7.8	29A RM 11	32A RM 12.6
7A RM 1.4	1.0000	0.9945	0.9965	0.9917	0.9879
9A RM 2.2	0.9945	1.0000	0.9936	0.9920	0.9950
26A RM 7.8	0.9965	0.9936	1.0000	0.9979	0.9871
29A RM 11	0.9917	0.9920	0.9979	1.0000	0.9876
32A RM 12.6	0.9879	0.9950	0.9871	0.9876	1.0000

Scatterplot Matrix



Legend

- PAH Compounds Concentration Normalized to Benz(a)anthracene

Notes

Identification numbers 7A, 9A, 26A, 29A, and 32A correspond to river mile location as indicated in the figure.

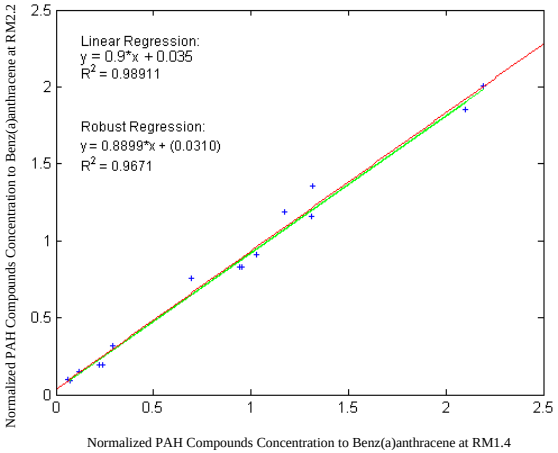
Data Source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

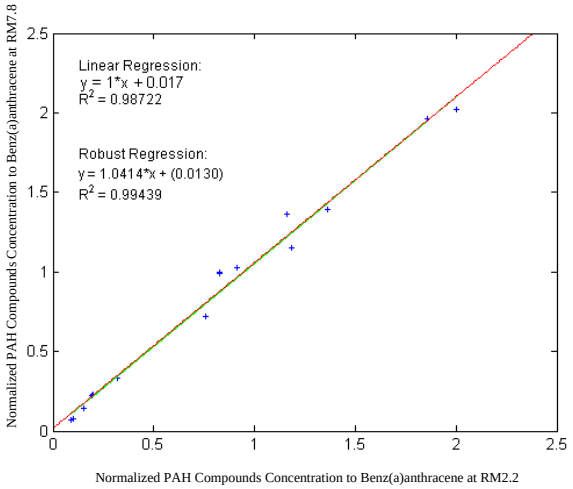
Correlation Among Sampling Locations for PAH Compounds Normalized to Benz(a)anthrazene for the Lower Passaic River High Resolution Cores Surface Sediments

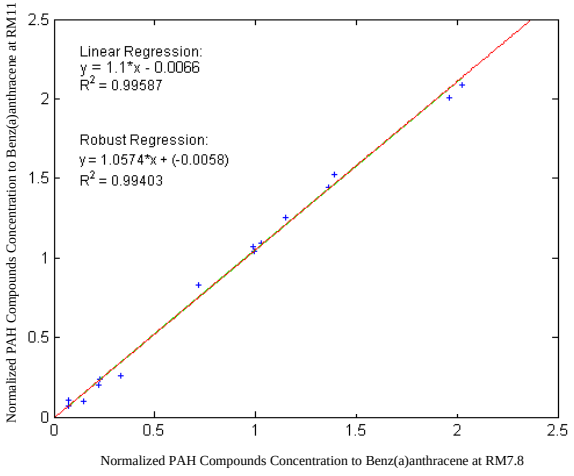
Lower Passaic River Restoration Project

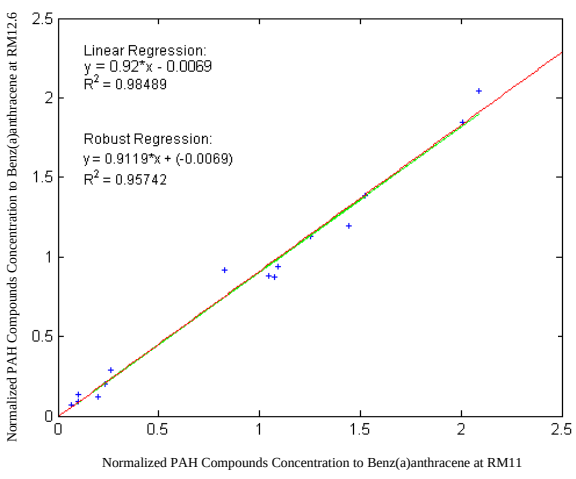
Figure 15-31

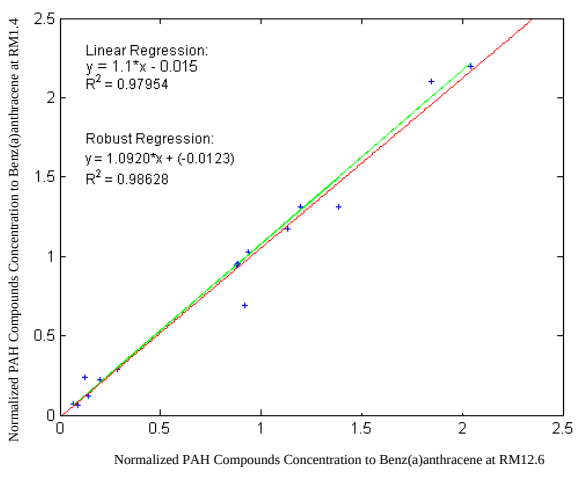
September 2008











Legend

PAH Compounds Concentration Normalized to Benz(a)anthracene

Linear Regression

Robust Regression

Notes

Linear and Robust Regression for PAH Compounds Concentration Normalized to Dieldrin in the Lower Passaic River High Resolution Core Surface Sediments

Lower Passaic River Restoration Project

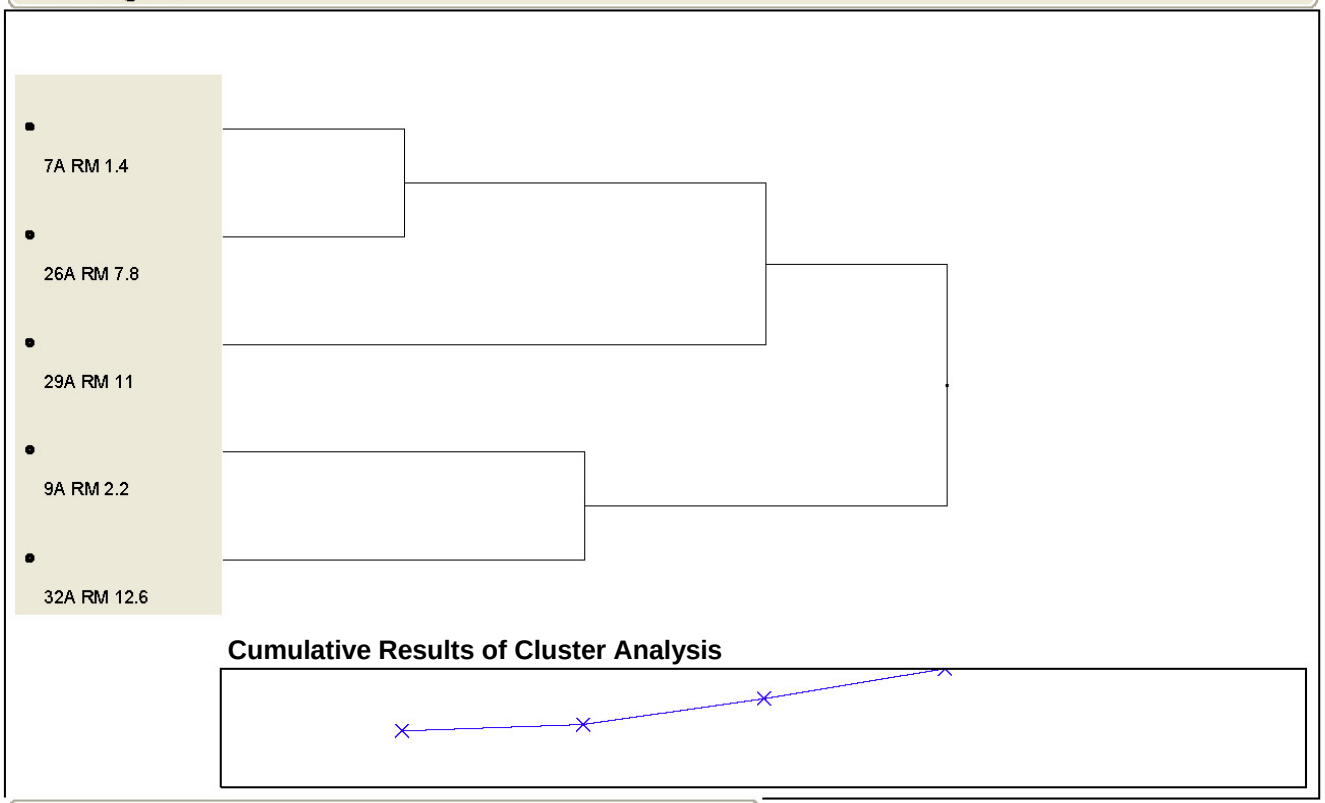
Figure 15-32

September 2008

Hierarchical Clustering

Method = Ward

Dendrogram



Clustering History

Number of Clusters	Distance	Leader	Joiner
4	2.560911359	7A RM 1.4	26A RM 7.8
3	2.852350366	9A RM 2.2	32A RM 12.6
2	4.023876300	7A RM 1.4	29A RM 11
1	5.395762219	7A RM 1.4	9A RM 2.2

Legend

Notes

Identification numbers 7A, 9A, 26A, 29A, and 32A correspond to field location numbers of 2005 USEPA High Resolution Sediment Cores.

The hierarchical cluster analysis utilizes Ward's minimum variance method.

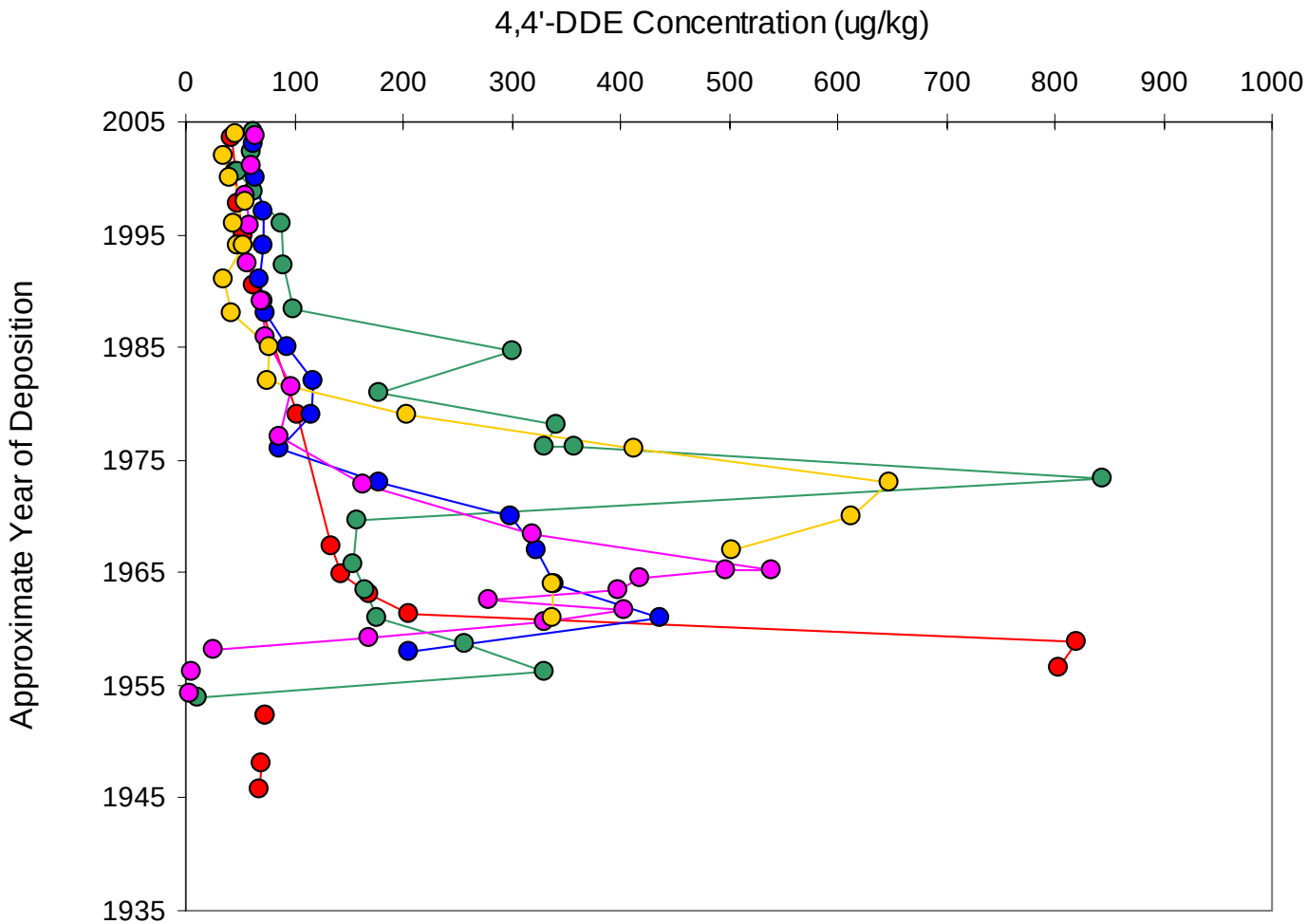
Data Source:USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dendogram of Sampling Locations Cluster Analysis for PAH Compounds in Lower Passaic River Surface Sediments

Lower Passaic River Restoration Project

Figure 15-33

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

DDE represents only the 4,4'-isomer.

Nondetect concentrations plotted as zero.

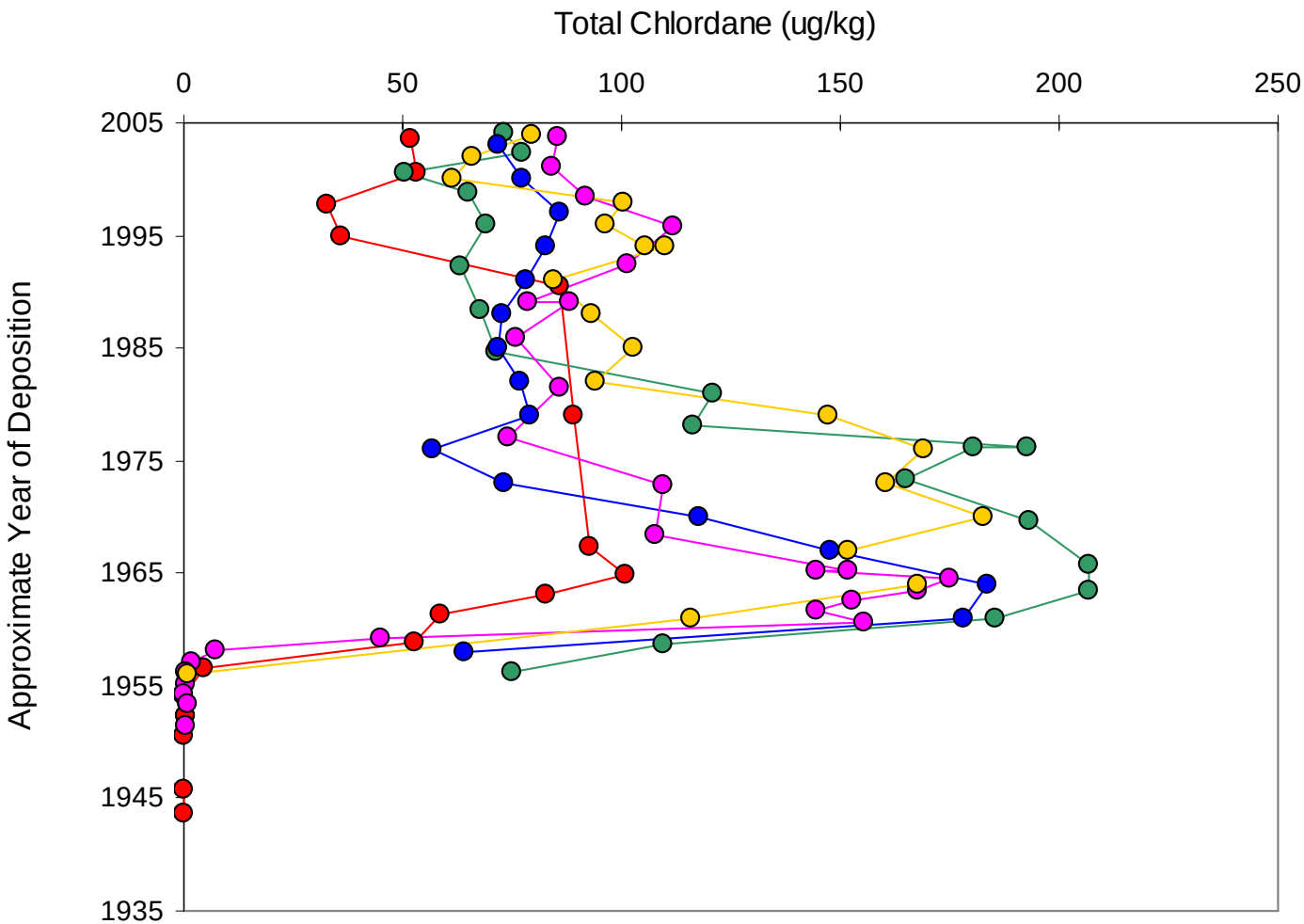
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for 4,4'-DDE Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-34a

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Total Chlordane represents the sum of trans-chlordane and cis-chlordane with nondetects equal to zero.

Nondetect concentrations plotted as zero.

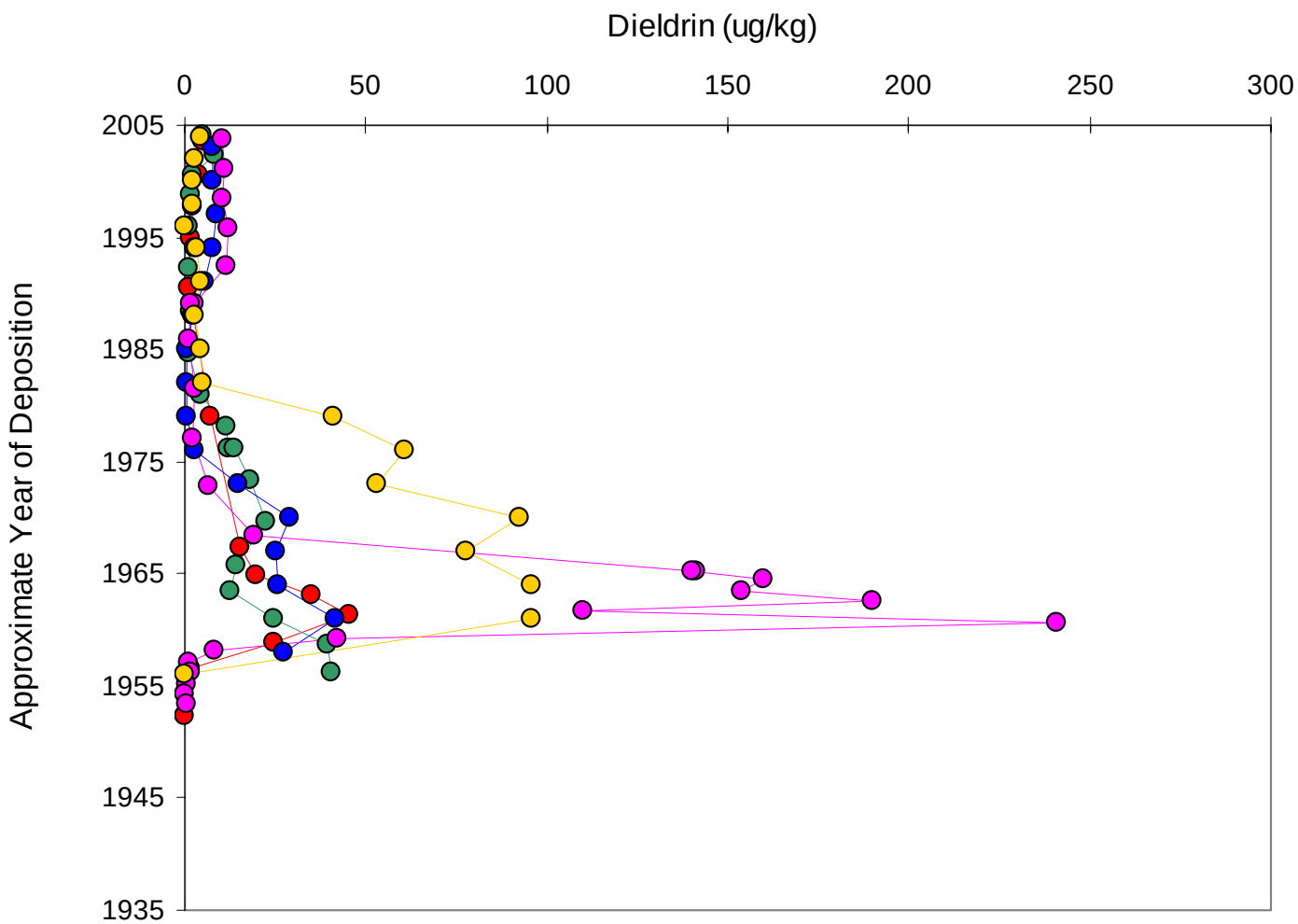
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for Total Chlordane Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-34b

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Nondetect concentrations plotted as zero.

Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for Dieldrin Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-34c

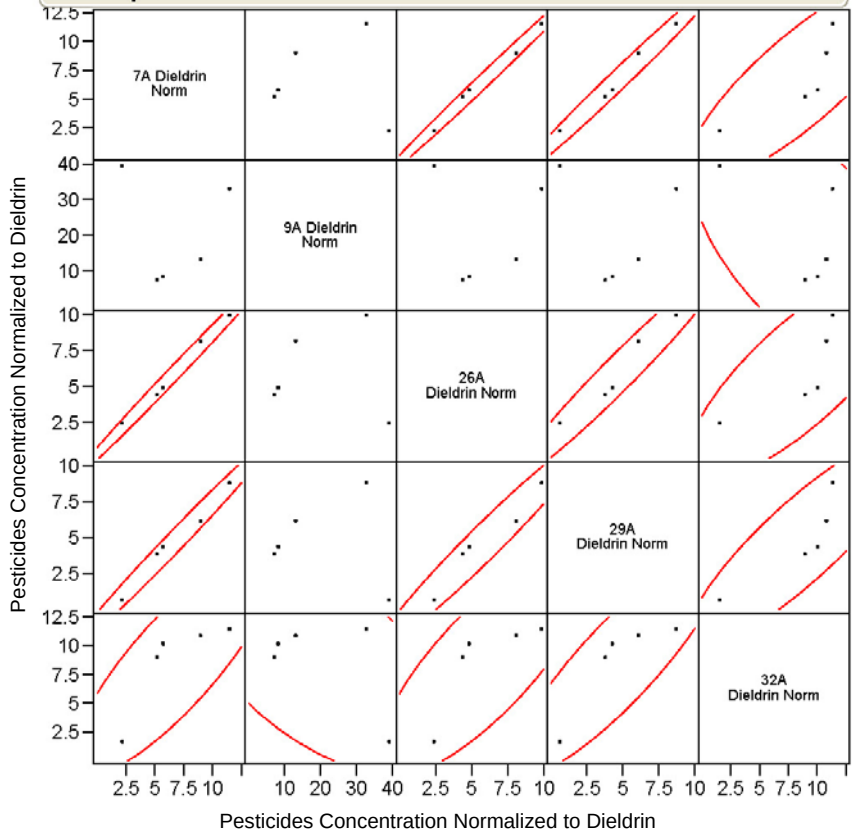
September 2008

Multivariate

Correlations

	7A Dieldrin Norm	9A Dieldrin Norm	26A Dieldrin Norm	29A Dieldrin Norm	32A Dieldrin Norm
7A Dieldrin Norm	1.0000	-0.0474	0.9959	0.9915	0.8338
9A Dieldrin Norm	-0.0474	1.0000	0.0013	-0.1104	-0.5734
26A Dieldrin Norm	0.9959	0.0013	1.0000	0.9757	0.7952
29A Dieldrin Norm	0.9915	-0.1104	0.9757	1.0000	0.8745
32A Dieldrin Norm	0.8338	-0.5734	0.7952	0.8745	1.0000

Scatterplot Matrix



Legend

- Pesticides Concentration Normalized to Dieldrin

Notes

Identification numbers 7A, 9A, 26A, 29A, and 32A correspond to field location numbers of 2005 USEPA High Resolution Sediment Cores.

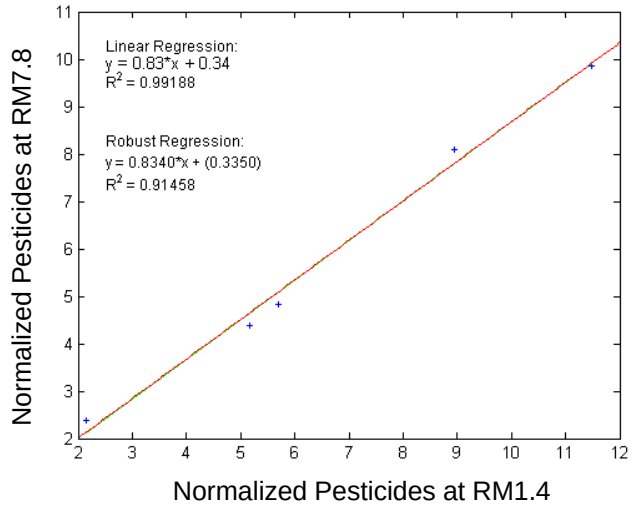
Data Source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

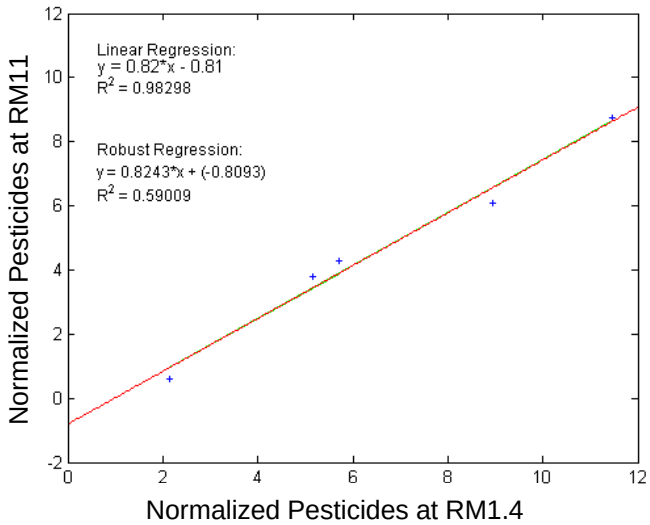
Correlation Among Sampling Locations for Pesticides Compounds Normalized to Dieldrin for the Lower Passaic River High Resolution Cores Surface Sediments

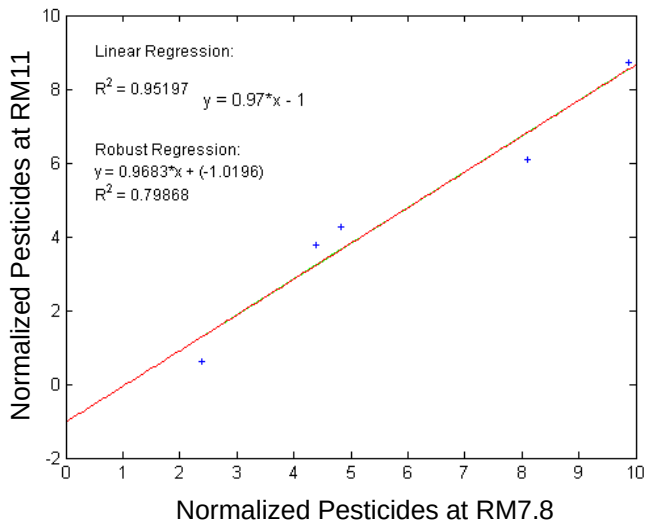
Lower Passaic River Restoration Project

Figure 15-35

September 2008







Legend

Pesticides Concentration Normalized to Dieldrin

Linear Regression

Robust Regression

Notes

Linear and Robust Regression for Pesticides in the Lower Passaic River Surface Sediments

Lower Passaic River Restoration Project

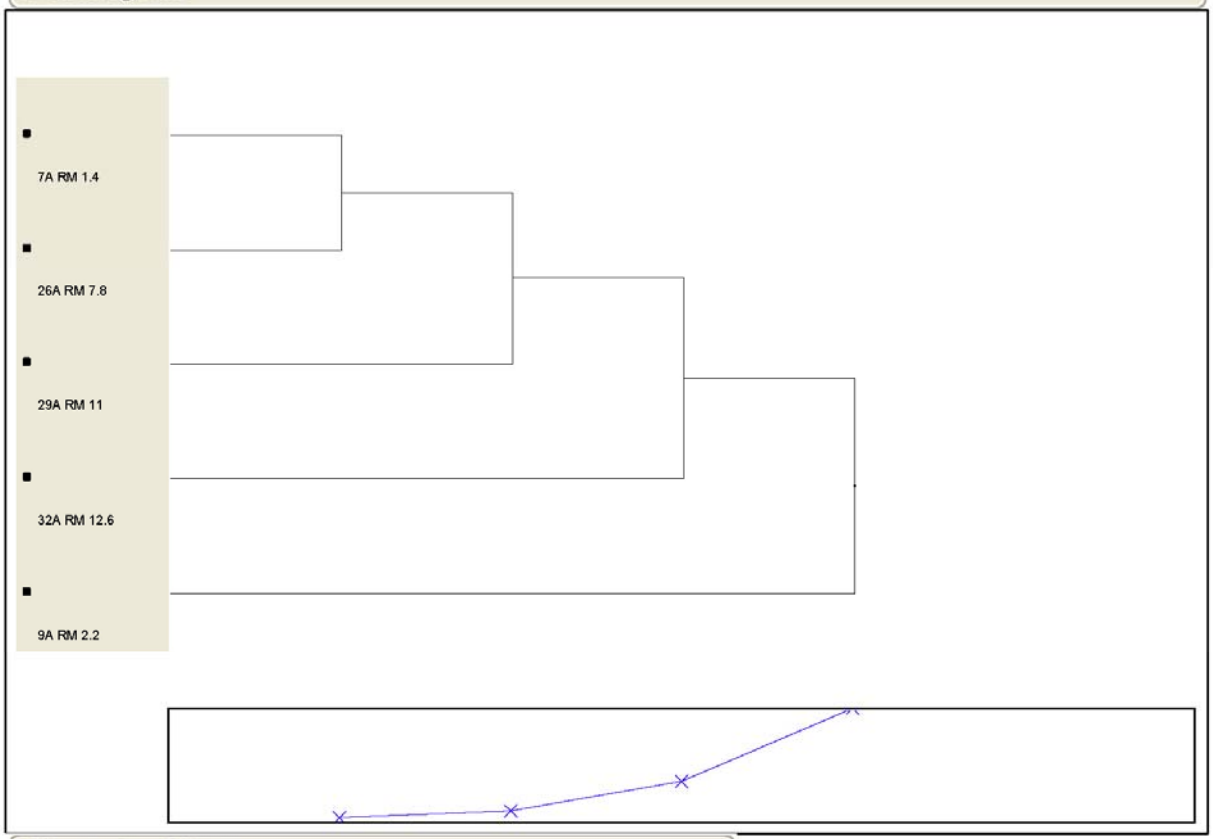
Figure 15-36

September 2008

Hierarchical Clustering for Pesticides Normalized to Dieldrin

Method = Ward

Dendrogram



Clustering History

Number of Clusters	Distance	Leader	Joiner
4	0.127535775	7A RM 1.4	26A RM 7.8
3	0.286702558	7A RM 1.4	29A RM 11
2	0.984085832	7A RM 1.4	32A RM 12.6
1	2.711898948	7A RM 1.4	9A RM 2.2

Legend

Notes

Identification numbers 7A, 9A, 26A, 29A, and 32A correspond to field location numbers of 2005 USEPA High Resolution Sediment Cores.

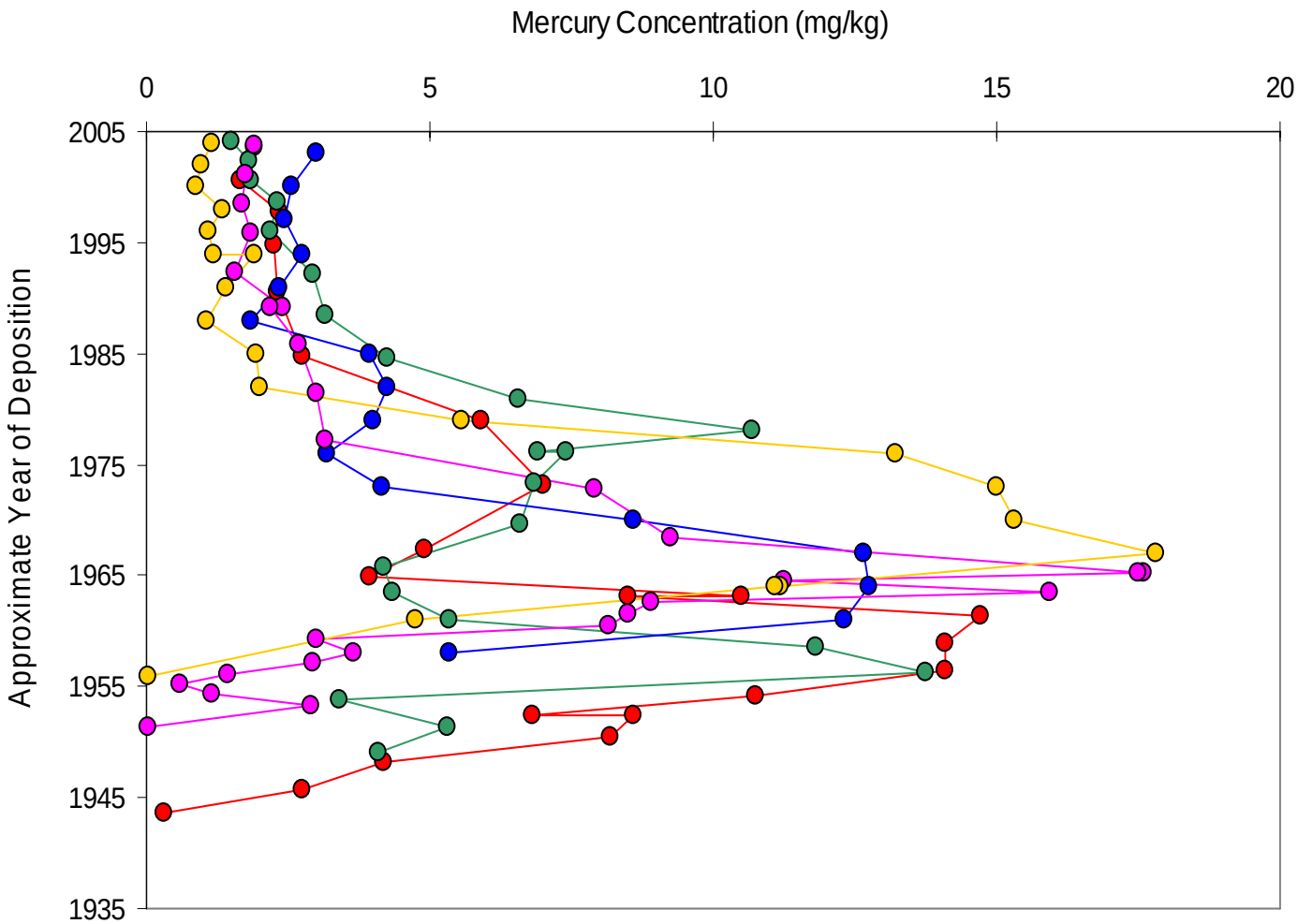
Data Source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dendogram from Cluster Analysis of Sampling Locations for Pesticide Compounds Normalized to Dieldrin in Lower Passaic River High Resolution Cores Surface Sediments

Lower Passaic River Restoration Project

Figure 15-37

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Nondetect concentrations plotted as zero.

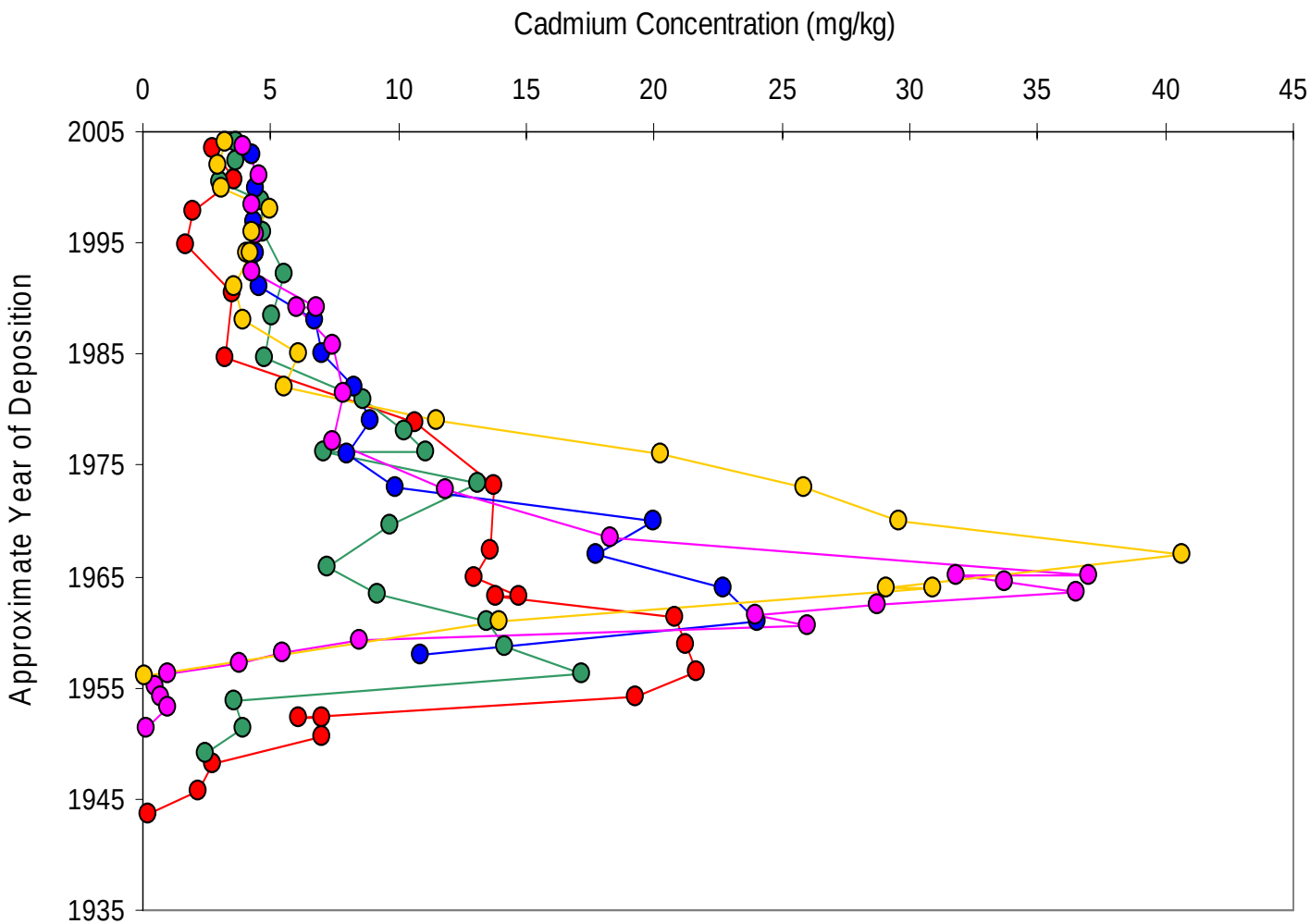
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for Mercury Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-38a

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Nondetect concentrations plotted as zero.

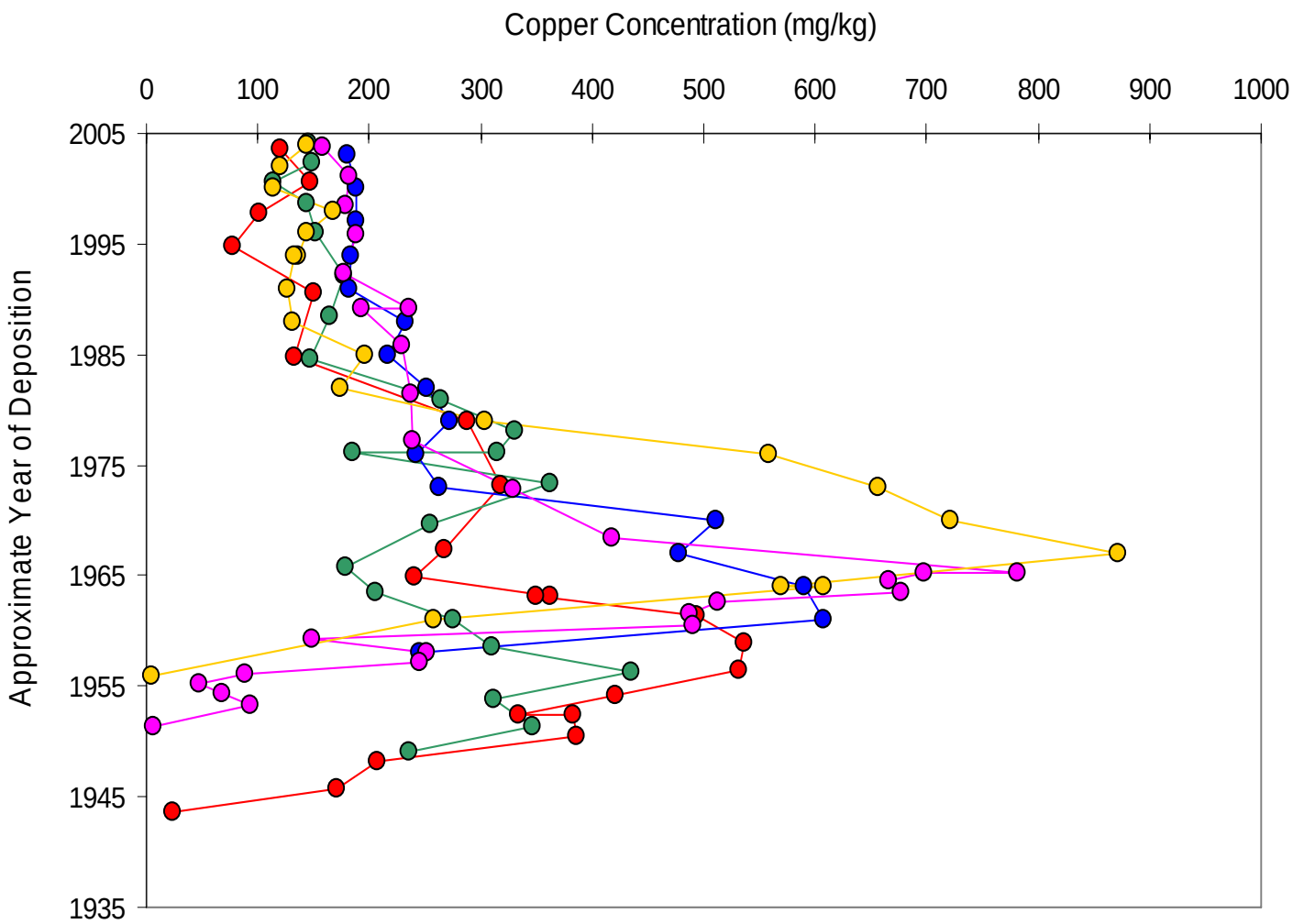
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for Cadmium Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-38b

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Nondetect concentrations plotted as zero.

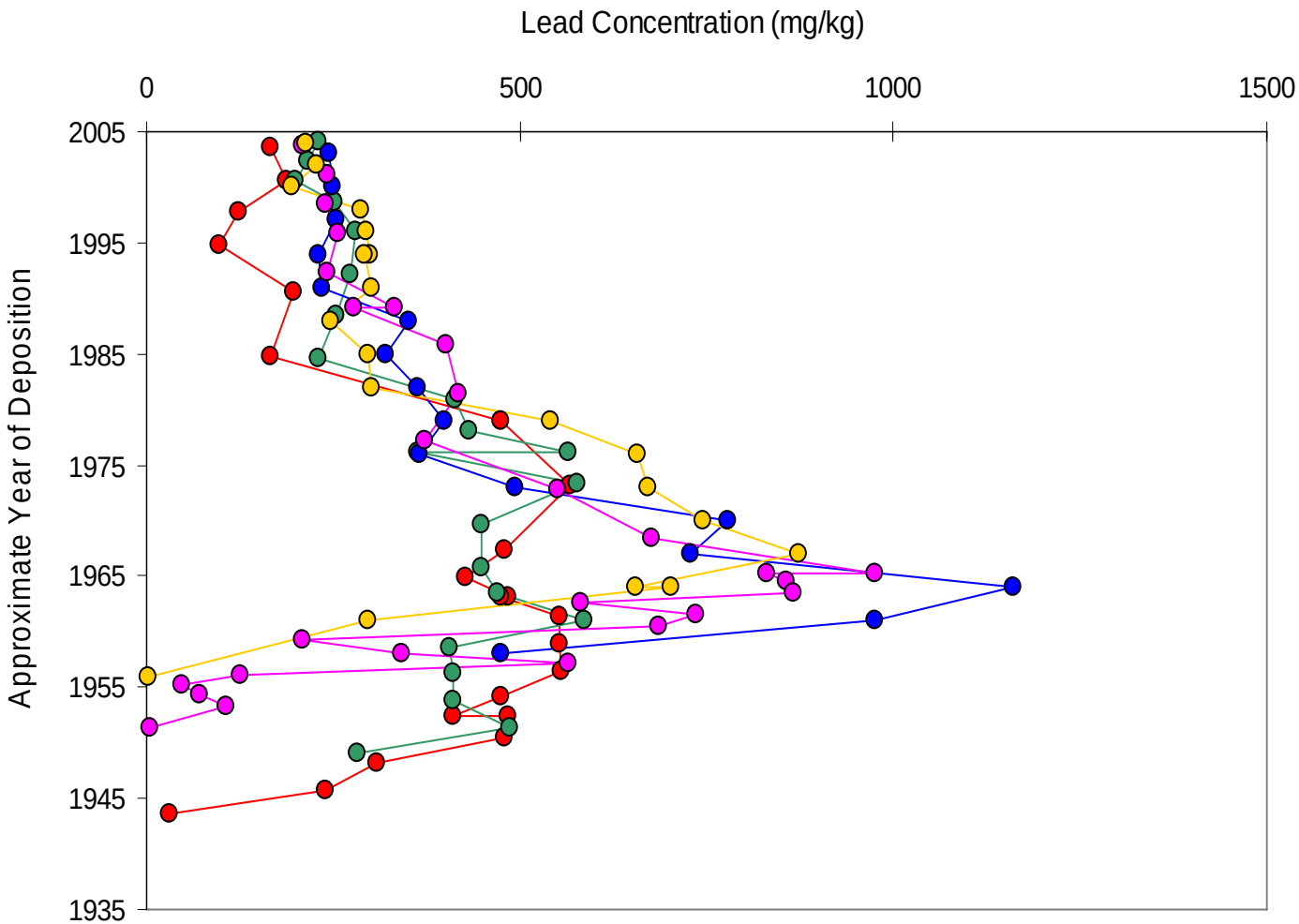
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

Dated Sediment Core Profile for Copper Concentration of Lower Passaic River High Resolution Sediment Cores

Lower Passaic River Restoration Project

Figure 15-38c

September 2008



Legend

- RM1.4
- RM2.2
- RM7.8
- RM11
- RM12.6

Notes

Nondetect concentrations plotted as zero.

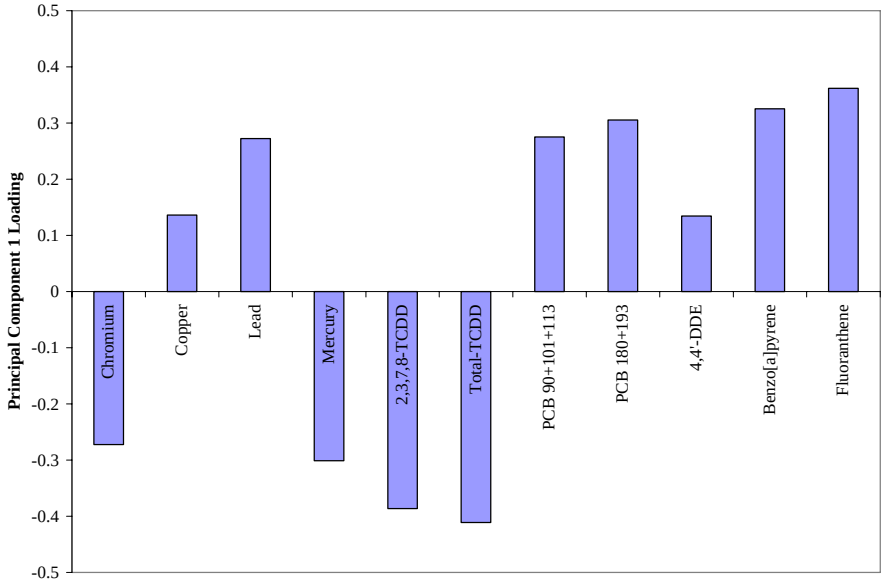
Data source: USEPA 2005 High Resolution Sediment Coring Program collected by Malcolm Pirnie, Inc.

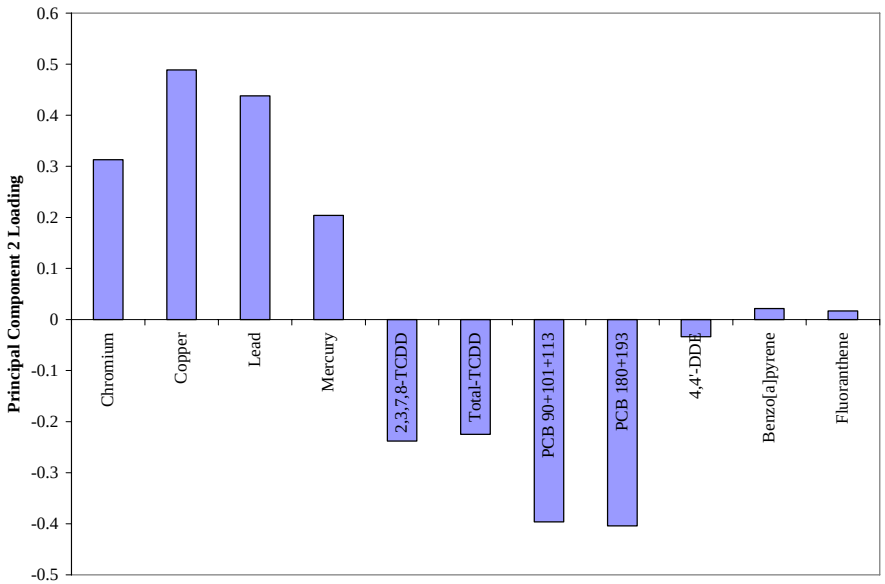
Dated Sediment Core Profile for Lead Concentration of Lower Passaic River High Resolution Sediment Cores

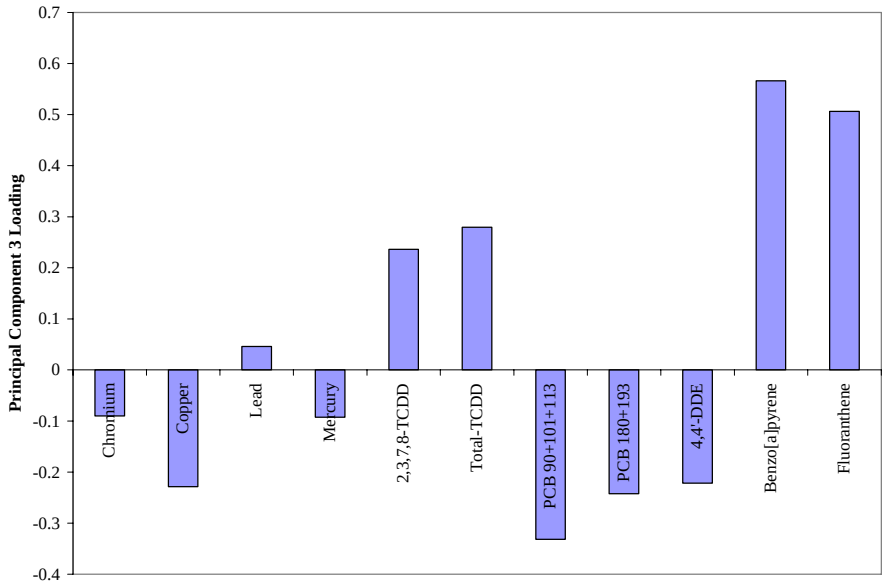
Lower Passaic River Restoration Project

Figure 15-38d

September 2008





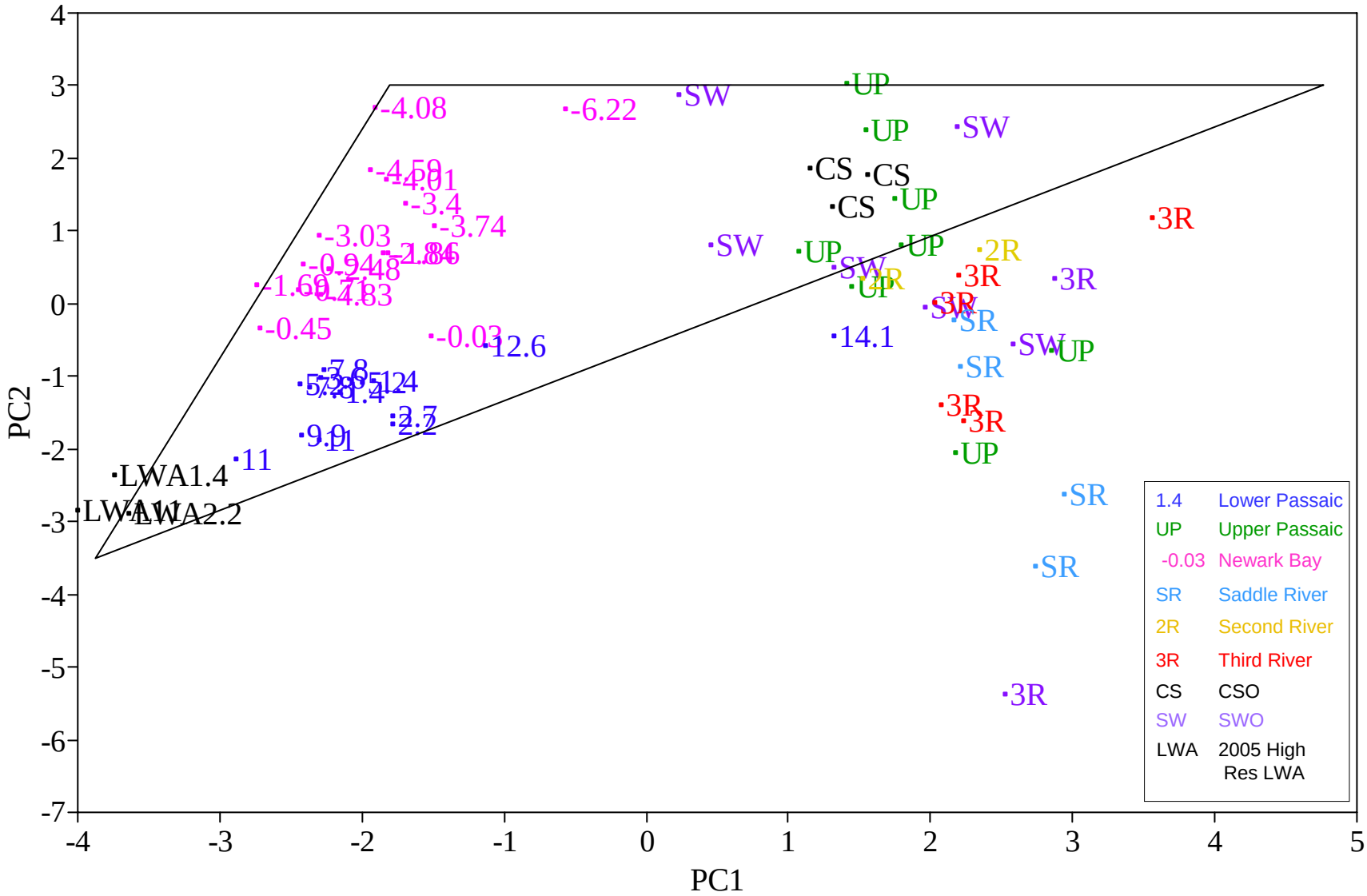


Combined Analytes Principal Components Loading

Figure 15-39

September 2008

Lower Passaic River Restoration Project



Combined Analytes Principal Component 1 vs. Principal Component 2

Lower Passaic River Restoration Project

Figure 15-40

September 2008